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EMPLOYMENT AND THE BUSINESS CYCLE[1]

WILLIAM A. BERRIDGE

I. INTRODUCTION

THE dual problem of employment and unemployment has recently attracted an unusual amount of attention. In part, the enhanced interest in the problem may be traced to the extraordinarily severe and widespread depression through which all industrial countries of the world have been passing. Interest of this sort, generated by depression, is commonly of a temporary nature — intense while unemployment is severe, but dwindling rapidly as acute unemployment disappears. A second and perhaps more enduring interest in certain problems of employment has sprung up during the past decade. Among business men, elements of cost involved in labor turnover, generally ignored a dozen years ago, have now become so widely recognized as to set a high premium on the stabilization of employment. Again, industrial leaders now see ways in which the employment cycle affects costs of maintenance of plant. In a business depression, underemployment of labor brings with it underemployment of factory space, machinery, railway cars, and many other forms of capital; in a business boom, the efficiency of labor tends to decline, not only because new workers of lower average grade are then hired, but also because indifference to work probably increases in the face of plentiful jobs in other establishments, and because overtiming probably increases industrial fatigue. A third cause for interest in employment lies in the profound influence of employment on the buying power of the population. Any shrinkage of employment tends to curtail the effective demand of the working group involved; this curtailment of demand may lead to further shrinkage of employment in other lines, then to further curtailment of demand, and so on. In every depression this vicious circle rapidly spreads until it involves, directly or indirectly, a very large part of the urban population. Moreover, employment affects buying power not only through its direct influence on the volume of earnings, but also indirectly through its influence on the rise and fall of rates of wages. In short, the three problems of labor turnover, the utilization of capital, and the marketing of products are three effective points of contact between the world of commerce and industry and the employment-unemployment cycle. The importance of these problems to business is indicated by a recent pronouncement of Mr. Herbert Hoover, who as Secretary of Commerce may be regarded as a leading spokesman for the business world. In press dispatches he is quoted as saying that the Department of Commerce expects soon to begin "the most scientific investigation ever undertaken, into fundamental problems of unemployment."

Notwithstanding the possible significance of the connection between unemployment and the business cycle, little study has been given to the relationship by writers on either of the two subjects. Sir William H. Beveridge, the noted English writer on unemployment, devotes a chapter of his book [2] to cyclical fluctuation, and seeks to show that cycles of unemployment occur, and that they bear some resemblance to cycles of industrial and business activity, as measured by annual data. He does not, however, examine the mechanism by which unemployment affects or is affected by these business cycles. Furthermore, his treatment of cyclical fluctuations is based almost wholly on annual statistics. Subsequent writers on unemployment have not carried the analysis essentially beyond the point at which Beveridge left it in 1908. Turning to the literature on business cycles, one finds that even leading authorities like Mitchell [3] and Persons[4] have given little or no attention to unemployment. In the literature both on unemployment and on business cycles, the common tendency has been to ignore the American measures of employment and unemployment, or to utilize them only in annual form and without any thorough-going technique.[5] It has been commonly assumed that, however closely the phenomenon of cyclical unemployment may be related to business cycles, the available indices of unemployment are not likely to furnish an accurate measure of the unemployment phenomenon, much less the actual condition of business. That common assumption now seems highly erroneous.

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[1] The present article is an abstract of certain portions of a thesis offered in partial fulfilment of the requirements for the doctorate in Harvard University. The writer wishes to signify his appreciation of the friendly interest in the investigation shown by the editors, especially Professor Edmund E. Day, and to acknowledge the clerical assistance rendered, not only by the staff of the Committee on Economic Research, but also by others including students in Radcliffe College and Harvard University. Special acknowledgment is due to Mrs. Jane F. Hersey and Mr. Harold M. Flinn.

[2] *Unemployment: a Problem of Industry*, London, Longmans, Green and Co., 1908.

[3] Wesley C. Mitchell, *Business Cycles*, University of California Press, Berkeley, 1913. Professor Mitchell makes several general references to unemployment, but only two are discussions of the data. He devotes four pages to annual unemployment data for the United Kingdom, France, Germany, and the United States (*op. cit.*, pp. 268–271). Two pages are given to

The purpose of the present study is threefold: (1) to examine and analyze the best available data on employment and unemployment, not only in the United States, but also in Great Britain, (2) to see what new light can be thrown, by the index method, on the course of employment cycles in those two countries, especially since 1903, and (3) to determine the relations between employment cycles and cycles of prices, production, speculation and other well-known economic indices.

Undoubtedly, reliable information as to the total number or percentage of persons actually unemployed in the country from month to month, or even as to the average number or percentage "normally" unemployed in the country would be extremely valuable, if it could be secured. In the view of the writer, however, it is impossible to make an estimate of either, that is, accurate within a low probable error, owing to the limitations of the available data on unemployment. From the beginning the present analysis has proceeded by a different method: the construction of a continuous *index* registering the *fluctuations* of employment over an extended period, but without any direct attention to the actual number of persons unemployed at any time. This form of attack greatly simplifies the attainment of our objective. The index method brings within the pale of usefulness certain data which probably have too great an absolute error to justify their use in measuring the volume of unemployment. For purposes of merely constructing an index of unemployment, the presence of a rather large element of absolute error in the original data need not spoil their merit, *so long as the degree of error does not fluctuate violently*, but either remains fairly steady or changes at a slow rate.[6]

II. A MONTHLY INDEX OF EMPLOYMENT COMPARED WITH PRODUCTION IN THE UNITED STATES, 1919–21[7]

A somewhat extensive analysis of employment and unemployment before the war is presented in the sections following the present one. Although the pre-war data prove surprisingly successful as indices of employment and production in the United States and Great Britain, a

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the number annually employed in coal mines of the United States, and only ten lines of text to unemployment data for the United States (p. 271). Professor Mitchell makes no effort to compare any unemployment data with other indices of business, nor does he treat any monthly data, except for Great Britain (p. 548).

[4] Warren M. Persons, *Indices of General Business Conditions*, Cambridge, Harvard University Press, 1919; or see REVIEW OF ECONOMIC STATISTICS, preliminary volume 1, pp. 3–205, January and April, 1919. Professor Persons, after an exhaustive search for significant American business indices on either an annual or a monthly basis, omitted unemployment data altogether.

[5] Numerous other writers might be cited who practically ignore the rôle of unemployment in the business cycle. Some admit, abstractly, the importance of unemployment in that connection, but ignore the available measures of it. Those who indicate any faith in unemployment indices generally rely only on the British data, which are commonly regarded as the best in the world. Some writers present data on unemployment but ordinarily in annual form and with practically no analysis. Among these may be mentioned T. E. Burton, *Financial Crises*, 1902; M. Tugan-Baranowsky, *Les Crises Industrielles en Angleterre*, 1913; and D. H. Robertson, *A Study of Industrial Fluctuation*, 1915.

[6] It is nevertheless true that the employment index yields, as a by-product, a rough check on estimates of the number reported unemployed at a given time. For example, corrected indices of employment presented in this paper have been used in the preparation of unemployment estimates for the recent national conference on unemployment. Two test methods of constructing such indices were proposed by the writer. Used in conjunction with an estimate of the number of persons employed in January 1920 (based on the Occupations Census of that month), one test indicated 3,000,000, the other 3,100,000 unemployed in manufacturing and mechanical industries at the peak of unemployment in midsummer of 1921. These results were found by the sub-committee which drafted the report to the Conference to be in harmony with the results of the special "unemployment survey" made by the United States Employment Service in September 1921.

Both investigations indicated that the estimated amount of unemployment as reported by the Department of Labor early in 1921 (5,700,000 persons) was too large by at least 1½ million and perhaps two million persons. See the *Special Letter* of October 8, 1921, Harvard Economic Service; also the final question naturally arises at the outset, as to their significance during the years since the war. However close the pre-war relationships may have been, have they been maintained, or modified or destroyed, in the post-war period? The question is particularly opportune now as we are "turning the corner" after a severe depression, when any failure of employment or other indices of business would be brought out in sharp relief. Some long-trusted indices of business have for various reasons broken down entirely, or at least have failed to register the business cycle as faithfully in recent years as before the war. Have the employment data too failed to stand the acid test of post-war experience? The following analysis seems to show that they have not failed. Although the current employment indices are different in their nature from those available in pre-war days, the relationship of employment to business cycles still stands out with great clearness.

The best materials for a post-war index of employment are found not in unemployment data but in employment data, and the best series reported currently, month by month, are those of the United States Bureau of Labor Statistics and the New York State Industrial Commission.[8] These two series are based upon returns from employers, who report the numbers of employees on their payrolls on one day each month; they include only manufacturing industries, omitting trade, building, and transportation.

In both geographical and industrial composition, the employment data of the United States Bureau of Labor Statistics are comprehensive, though they cover neither the entire area of the United States nor all kinds of industries. The numbers involved range from 500,000 to 800,000 employees. About three-fourths of these are distributed among six states situated in the northeastern industrial region of the country, and over nine-tenths among the following fifteen states:

TABLE 1. — GEOGRAPHICAL DISTRIBUTION OF UNITED STATES BUREAU OF LABOR STATISTICS DATA ON EMPLOYMENT

(*Unit: one per cent*)

	March 1920	July 1921
Pennsylvania	19.7	16.4
Massachusetts	12.8	14.9
Michigan	13.0	13.3
New York	12.6	12.2
Ohio	9.0	7.1
Illinois	6.8	6.9
New Hampshire	2.5	3.8
New Jersey	2.7	3.1
Missouri	2.2	2.7
Indiana	2.8	2.4
Maine	1.7	2.1
Rhode Island	1.5	1.8
Alabama	1.7	1.8
Connecticut	1.4	1.5
Colorado	1.3	1.1
All others	8.3	8.9
All states represented	100.0	100.0

The data cover fourteen industrial groups: (1) iron and steel, (2) car-building and repairing, (3) automobiles, (4) cotton goods, (5) textile finishing and dyeing, (6) hosiery and knit goods, (7) woolen and worsted goods, (8) men's clothing, (9) silk, (10) leather, (11) boots and shoes, (12) paper, (13) tobacco (including cigars and cigarettes), and (14) bituminous coal.

The data of the Bureau of Labor Statistics have appeared monthly in the *Labor Review* since October 1915. Those utilized by the present writer consist of month-to-month link relatives, based on identical establishments in the comparison of any two months. These links were combined to get chain relatives with January 1916 as 100 per cent, but the base was then

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Report of the President's Conference on Unemployment, pp. 52–56; and an article by Ernest S. Bradford, "Methods Used in Measuring Unemployment," *Quarterly Publication of the American Statistical Association*, 17, pp. 983–994. December, 1921. Mr. Bradford is interested almost wholly in the volume of unemployment. The incalculable advantage afforded by the method of measuring fluctuations of employment rather than the volume of unemployment, permits us to trace the relationship between unemployment and the business cycle — a project which without the use of the index method would be impossible.

[7] A summary of Section II has already appeared in the *Special Letter* of October 8, 1921 (Harvard Economic Service). The reader already sufficiently familiar with the post-war index may well turn immediately to Section III.

[8] The index inaugurated in January 1921 by the United States Employment Service is also promising. It includes a larger number of workers than either of the two indices mentioned above, it is based upon identical establishments throughout the entire period to date, separate indices are published for each of the fourteen standard industrial groups used by the Census of Manufactures, the reports are collected by telegraph and become available for use promptly. Other indices have also been recently set up by the Industrial Commission of Wisconsin and the Department of Labor of Illinois.

These series have been omitted from the present employment index since they do not cover the whole post-war period, nor even run back far enough into the past to establish a secure basis for test and comparison.

TABLE 2. — INDUSTRIAL WEIGHTS USED IN EMPLOYMENT INDEX OF UNITED STATES BUREAU OF LABOR STATISTICS

(Based on United States Census of Manufactures, 1914)

Industry	Wage Earners	
	Number *(thousands)*	Weight *(per cent)*
1. Iron and steel (blast furnaces, steel works and rolling mills)	278	12.0
2. Car building and repairing (steam cars, by railroads and other companies)	394	17.0
3. Automobiles (including bodies and parts)	127	5.5
4. Cotton goods	379	16.4
5. Dyeing and finishing textiles (exclusive of that done in textile mills)	48	2.1
6. Hosiery and knit goods	151	6.5
7. Woolen and worsted goods	159	6.9
8. Men's clothing	174	7.5
9. Silk goods (including throwsters)	108	4.7
10. Leather (tanned, curried and finished)	56	2.4
11. Boots and shoes (including cut stock)	199	8.6
12. Paper (including wood pulp)	88	3.8
13. Tobacco (including cigars and cigarettes)	153	6.6
Total	2,314	100.0

shifted to the 1919 average as 100 per cent, and new relatives computed for each of the fourteen industries. The index of the Bureau is a weighted arithmetic mean of the chain relatives,[9] the weights being the total numbers employed in the industries according to the 1914 Census of Manufactures.[10]

The employment data published since June 1914 by the New York State Industrial Commission are somewhat similar to those of the Bureau of Labor Statistics.[11] They cover a wide field of manufacturing activity, involving in March 1920 over 600,000 and in June 1921 over 450,000 employees, or about one-third of the factory workers of the entire state. The series used here is the index of employment based on June 1914 as 100 per cent; for a given month, only those establishments are used which also reported in June 1914. Data for eleven major industrial groups are published, but indices for the sub-groups can be, and in certain cases were, segregated. Here as before the base of the indices was changed to the average for 1919 as 100 per cent. The relative importance of the industrial groups and of certain leading sub-groups is shown by Table 3. The employment index, unlike the pre-war unemployment indices for New York state, did not fluctuate greatly in industrial composition, and consequently did not require a recombination with fixed weights.

TABLE 3. — INDUSTRIAL COMPOSITION OF NEW YORK STATE EMPLOYMENT DATA AT SELECTED DATES

(Unit: one per cent)

	March 1920	June 1921
Metals, machinery and conveyances	38.4	30.1
(Machinery, including electrical apparatus)	(11.1)	(9.4)
Textiles	10.8	12.4
Clothing, millinery, laundering, etc.	13.2	14.6
Furs, leather, and rubber goods	7.7	8.3
(Boots and shoes)	(4.4)	(5.1)
Food, beverages and tobacco	8.0	10.6
Printing and paper goods	7.3	8.4
(Printing and bookmaking)	(5.3)	(6.5)
Paper	1.6	1.2
Chemicals, oils, paints, etc.	5.3	6.0
Wood manufactures	4.6	4.8
Stone, clay and glass products	2.3	2.6
Water, light and power	0.8	1.0
Total	100.0	100.0

These New York data are nearly but not quite independent of those collected by the United States Bureau of Labor Statistics. (See Table 1.) Only 12 or 13 per cent of the wage earners embodied in the latter series are employed in New York establishments, and of these probably some belong in establishments which do not report to the State Commission.

Although one of these indices relates to only one state, and the other to nearly the entire industrial section of the country, they both follow nearly the same course during most of the period under review; the coefficient of correlation is +95 per cent (see Chart 1). There are certain important discrepancies; for example, they disagree as to the precise month in which turning points occurred, upward in early 1919 and downward in early 1920. Much more striking is the fact that during 1921 the New York curve continued downward until August, while the Bureau of Labor curve has moved fairly steadily upward. The contradiction is more apparent than real; comparing Tables 2 and 3, we find that the Bureau of Labor index is based much more heavily on textile and clothing — especially textile — industries than on any others; the combined weight of these groups (items 4–9) is about 45 per cent of the total, and that of iron and steel and related industries (items 1–3) only 35 per cent. The New York index, on the other

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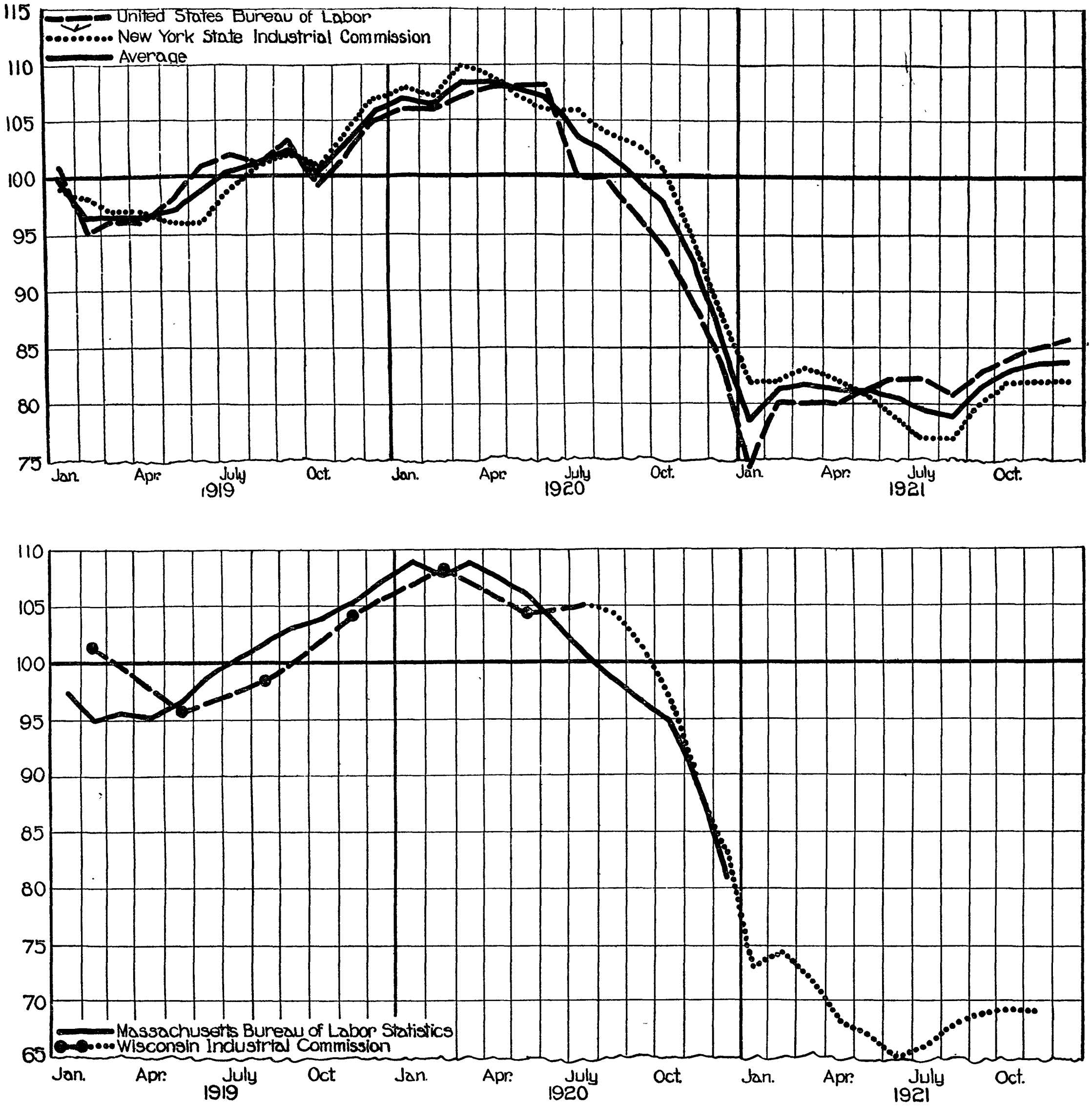
[9] Group 14, bituminous coal mining, was omitted from the combined index.

[10] The weights shown in Table 2 have been supplied by courtesy of the Commissioner of Labor Statistics, Mr. Ethelbert Stewart. The numbers actually involved in the reporting establishments would be a very unsatisfactory basis for weighting, since some industries, such as iron, steel, and automobiles, are very much more strongly represented in the employment reports than their importance would justify.

[11] Until August 1921 these data appeared in the *Labor Market Bulletin*; this publication has since been superseded by a new publication, the *Industrial Bulletin*.

Chart 1. — Comparison of Leading Post-War Indices of Employment

(1919 monthly average = 100 per cent)



hand, gives a weight of only 20 to 27 per cent to clothing and textiles (especially clothing) and between 30 and 38 per cent to metals, machinery and conveyances. These differences in composition fully account for the earlier rise of the Bureau of Labor Index in 1919 and in 1921, because its predominant group, textiles, on both occasions commenced recovery prior to iron and steel. The New York index declined first in early 1920 because clothing is represented in it more heavily than are textiles proper, and clothing showed depression before textiles (compare Chart 3).

Which of these two indices is probably nearer the true course of employment? Undoubtedly the Bureau of Labor index has a marked advantage in its geographical comprehensiveness, but, on the other hand, the following study has shown that employment fluctuations in New York state are highly sensitive to, and typical of, industrial conditions in the country. The Bureau of Labor index certainly overweights textiles; the New York index, if it overweights metals, is not thereby impaired in value, since it has been shown that employment cycles in metal industries reflect very accurately those in all industries combined. All in all, the advantages of the New York index seem to equal — perhaps even to exceed—those of the United States Bureau of Labor. The accompanying study seems to justify giving as much weight to the New York series as to the other; accordingly the two were averaged [12] forming the middle curve in the upper half of Chart 1. The seasonal element is present but unimportant in both series. In the lower half of Chart 1 is shown the supporting evidence afforded by adjusted employment indices for Massachusetts and Wisconsin. The reader may readily see, by comparing these curves with each other and with the two primary indices in the upper half of the chart, that the outstanding movements took place in all the curves at nearly the same time. There is no clear nor consistent lagging tendency, and such differences as appear in amplitude can be readily accounted for.[13]

This post-war index of employment serves several purposes. First, and most directly, it registers the course of the labor market. Secondly, it indicates approximately the buying power of the wage-earning population from current earnings. An increase or decrease in employment brings with it a corresponding increase or decrease in the aggregate earnings, even if wage rates remain the same. Moreover, the rate of wages itself responds to fluctuations in employment, since wage rates tend to be high when employment is active, and low when employment is dull. Thus full employment at high rates increases the purchasing power of labor; unemployment decreases that power. Finally, the employment index gives us an indirect measure of production. In Chart 2 the employment index is compared with Professor Day's monthly index of the volume of manufacture. Throughout the three years covered, the curves representing employment and production show change of direction at nearly the same time. Every critical movement is shown with almost equal clearness in both curves: the relapse after the armistice, the recovery in the second, third, and fourth quarters of 1919, the culmination of the boom early in 1920, the ebb of prosperity, at first slow, then precipitate, until the middle of 1921, and the gradual improvement since August. The correlation coefficient is +96 per cent, even higher than that between the two indices of employment.

Three significant differences between the curves appear. (1) Unlike production, the employment index was unaffected by the varying lengths of the months. In each February, for instance, production slumped owing primarily to the ten per cent difference in the number of days included; until corrected for seasonal variation the production index therefore represents less well than employment the varying *intensity* of industrial activity. (2) Moreover the employment curve was much less disturbed than the production curve by the various strikes of September to December 1919.[14] Partial explanation for this may be found in the fact that the supply of basic materials, which are the chief constituent of the production index, was perhaps affected much more by these disturbances than was the manufacture of semi-finished and finished goods, which maintained itself during the interval, presumably on a carryover of raw materials. Moreover, employers doubtless hold their labor force over a temporary shortage of raw materials incident to labor disputes in key industries; at least this is very likely at a time of prosperity such as the autumn and winter of 1919–20. (3) The production curve, if the temporary effect of these labor disputes is smoothed out, clearly rose to a greater height in the boom of 1919–20, and recently fell to a greater depth, than did the employment curve. Employment rose only about 8 per cent above its 1919 average, but production increased twice as much; in the recent depression employment fell only about 20 per cent, production 27 per cent, below the average for 1919. In other words, the production index fluctuates over a wider range than the employment index.

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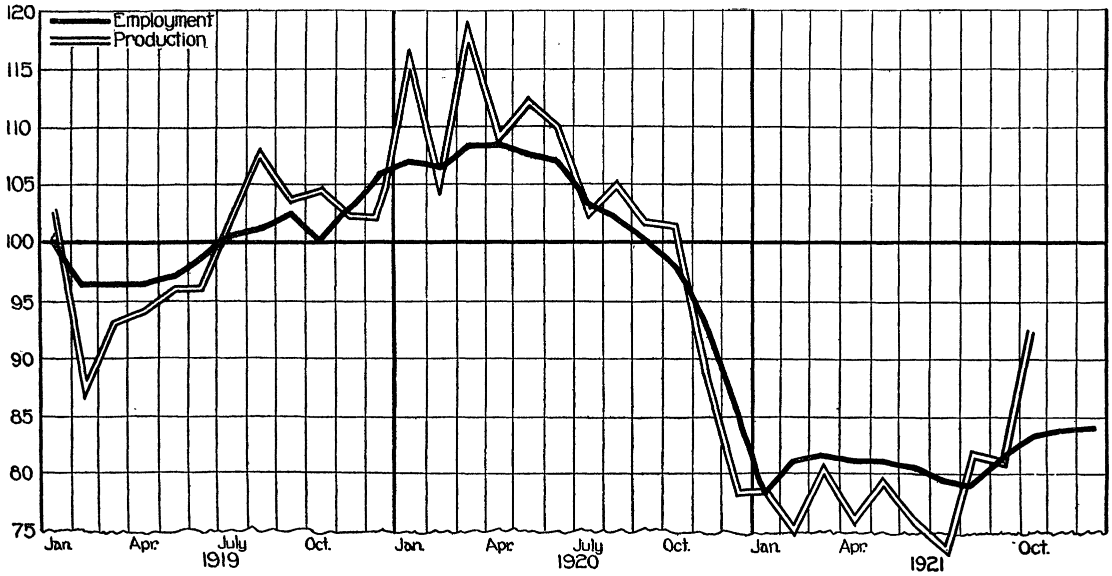
[12] Experiments were also made with the construction of a "hybrid" index by selecting from both sets of reports the best series representing leading industries, and combining these. Machinery, for example, is represented in the New York index alone; clothing is better represented there than in the Bureau of Labor data. The process of selection and recombination did not appear to bring out the advantages of the two sets of data better than does the simple average.

[13] The Wisconsin curve really represents two series, grafted together by the Industrial Commission of that state. The greater amplitude of its fluctuation is probably due in part to the process of combining too dissimilar series, and in part to variable weighting introduced by war industries. The writer has been unable to remedy the hidden defects, as the necessary data have not been published, but Mr. A. J. Altmeyer, Statistician of the Commission, now plans to standardize the weights, hoping to render the series more homogeneous.

The Massachusetts index has been adjusted to include all manufacturing in the state, according to the United States Census of Manufactures for 1919. No data are yet available for 1922 except for a small number of establishments; the resulting data are not homogeneous with the complete totals shown for 1919 and 1920.

Chart 2. — Indices of Employment and Production

(*1919 monthly average = 100 per cent*)



To what is this difference in the amplitude of the two indices due? It is impossible to get conclusive evidence on this point, but three considerations bear upon it. First of all, employment data are based on the number of employees on payrolls, and therefore understate the real extent of labor activity in prosperity, since overtime work does not increase the number reported; they also overstate the extent of activity in depression, since part-time work does not decrease the number. In other words, no distinction is made, in the employment figures, between workers who are engaged part time, full time and overtime. To a certain extent this source of inaccuracy is counterbalanced by a second consideration — fluctuations in the efficiency of labor. During prosperity labor efficiency is likely to diminish, partly because of industrial fatigue due to speeding and working overtime, partly because of indifference to duty in the face of plentiful opportunities for work in other establishments, and partly because of the hiring of untrained or inferior workers; in a depression the reverse is the case. A third consideration is the fact that the production index is necessarily derived, in large measure, from data on the production of basic materials, such as sole leather and steel ingots, rather than finished goods, such as shoes and machinery. The reason is that, in more advanced stages of manufacture, units of output are so varied and complex that few reliable data on production at these stages can be obtained. The employment data, on the other hand, relate to industrial groups at all stages of fabrication. If the production of basic materials responds more decisively to the course of the business cycle than do finished goods, the production curve would naturally swing through a greater range of variation than the employment curve.

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[14] In addition to the steel and soft-coal strikes, which affected industry in general, important strikes took place almost simultaneously in the printing and woodworking industries.

Changes in labor efficiency would thus lead to wider fluctuations in the employment curve than in the production curve. On the other hand the existence of overtime or part-time work, and the probably greater sensitiveness of the production of basic materials would lead to narrower fluctuations in the employment curve, such as Chart 2 actually shows.[15] Although little can be said as to the relative importance of these factors, probably the failure of employment data to take account of overtime or part time is the main reason for the narrower range of fluctuations.

In Chart 3 are shown employment indices for certain industrial groups, selected partly from the New York Industrial Commission, and partly from the United States Bureau of Labor Statistics. Examination of Chart 3 will disclose certain striking general facts, such as the depressed condition of late 1920 in the wool industry and that of early 1921 in the automobile industry, the recent tendency to recovery in many lines and the persistent failure of iron and steel, machinery and car-building to show any marked sign of improvement until August. Chart 3 also enables us to determine (1) the order in which the depression overtook the various industries, (2) the relative severity with which it appears to have affected them, and (3) the order in which recovery appeared in each important industry. A similar review, based on the production data, appeared in the *Special Letter* of September 20, 1921. Judgments based on the employment figures, where both employment and production data for the same industries are available, are nearly identical with those based on production figures.

Apparently the first to feel the depression of 1920 were the food and leather industries, in which decline began in the months from December 1919 to February 1920. Then followed automobiles (April), boots and shoes (April), clothing, etc. (April), woolens (June). After a considerable lapse came cotton manufactures (August), machinery, including electrical machinery (August), wood manufactures (October), iron and steel (November), paper (November), printing and book-making (December), and chemicals (December). From the employment data, the depression appears to have been most severe in the automobile and woolen industries, less severe, though still severe, in car-building and iron and steel. Machinery and leather rank next, then come boots and shoes, paper, wood manufactures, clothing; and least affected of all were cotton manufactures, printing, chemicals, oils and paints, and food, beverages and tobacco.

The recovery from depression seems first to have set in about February 1921, when it appeared in many lines — woolen, cotton, clothing, automobiles, food, beverages and tobacco, and boots and shoes. Both leather and wood manufactures improved for a time, but received a slight set-back near the middle of the year. Paper and printing did not show recovery until July. For iron and steel the data for August show a turn for the better, as do also those for car-building. Although food and the automobile industries have recently slumped again, most other industries continue to improve.

The employment index clearly registers production both for all industries and for each leading industry separately. The employment and production indices render nearly the same verdict as to the timing of the ebb and flow of the industrial cycle. The production of basic materials embodied in the production index, we also conclude, reflects faithfully changes in production all along the line, since the production curve agrees with the employment curve, which covers

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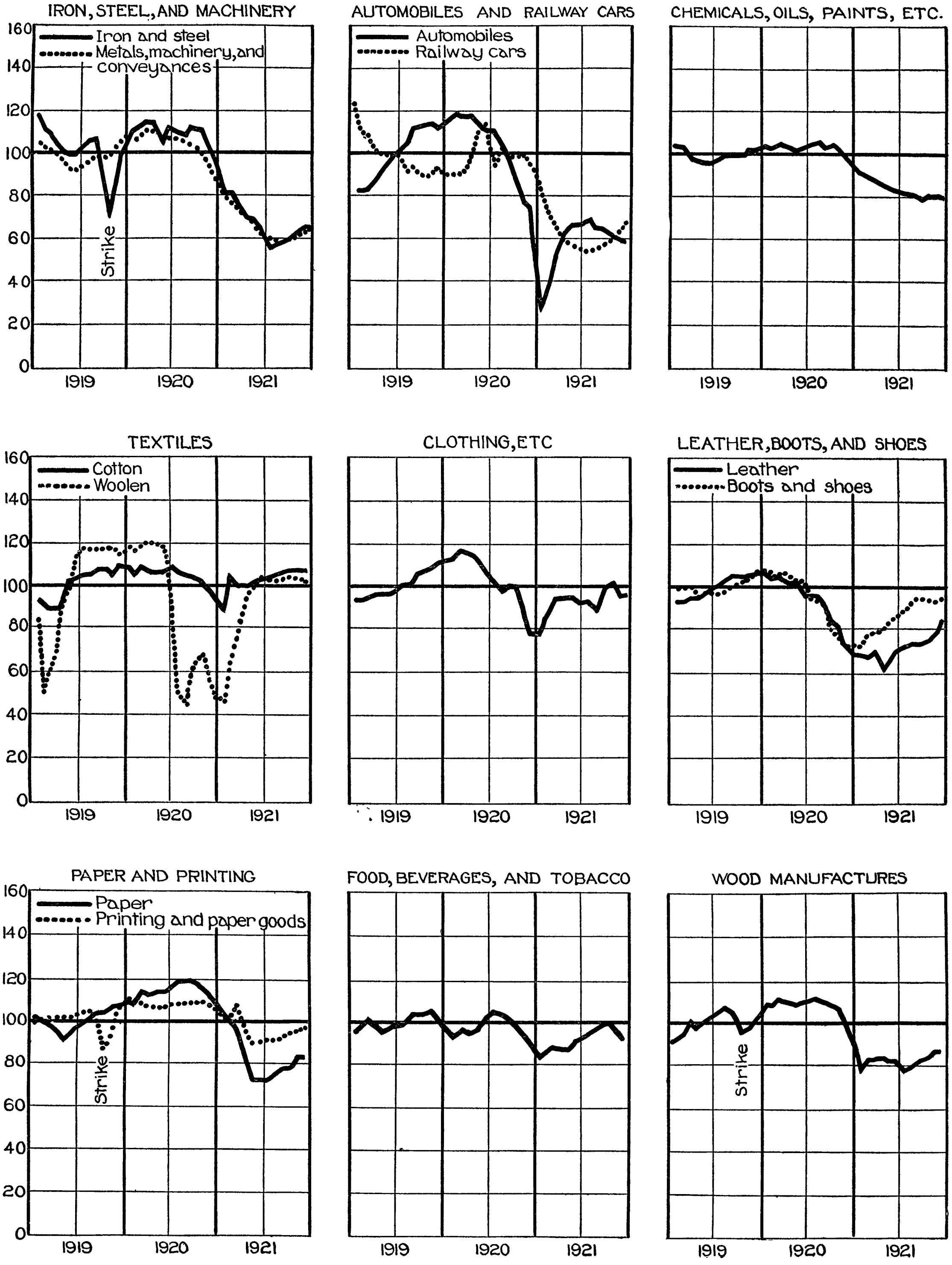
[15] Incomplete allowance for "mushroom establishments" also tends to reduce the amplitude of the employment boom. The New York Industrial Commission definitely excludes these by covering only establishments which reported in June 1914; the United States Bureau of Labor Statistics does not.

Chart 3. — Indices of Employment in Leading Groups of Manufacturing Industries

(1919 monthly average = 100 per cent)



industries at all stages. In amplitude, or sensitiveness of fluctuation, however, the two curves show noticeable but accountable differences. A clarified view of the course of the industrial cycle can be obtained by studying the employment and production curves jointly. No further materials are available for testing similarly the validity of the employment index as such, but one thing is certain: the natural presumption that the employment index registers the course of the labor market is greatly reënforced by the findings as to its relationship to production.

III. PRE-WAR DATA ON EMPLOYMENT AND UNEMPLOYMENT

Before the war, no comprehensive and continuous data on employment in the United States as a whole were reported. For many years the Bureaus of Statistics in Massachusetts and New Jersey have published in their annual reports the numbers employed during each month of the preceding year in a certain number of manufacturing establishments in those states; but the nature of these data renders highly inadvisable their use as the central basis for a continuous index of employment. The comprehensiveness of both series with reference to the aggregate manufacturing industry in the two states changed during the period owing to changes of policy on the part of the Bureaus. Moreover, there was marked irregularity from year to year; the number of reporting establishments varied widely between consecutive calendar years — and even within the course of each year, after 1906, in Massachusetts. It is difficult to make a sufficiently trustworthy adjustment from year to year to justify use of these data except as secondary evidence.[16] In addition to the New Jersey and Massachusetts data, the United States Bureau of the Census also published, in the quinquennial Census of Manufactures, the numbers employed in manufacturing establishments, for each month of the census years 1899, 1904, 1909, and 1914. These census data form the nearest approach to comprehensive American measures of employment, but were necessarily omitted from the present employment index, owing to their discontinuous nature. This same necessity forces us to regard as merely secondary evidence the irregular data on employment in manufacturing industries reported by the New Jersey and Massachusetts Bureaus of Labor Statistics.[17]

To secure materials suited to the construction of a continuous pre-war index of employment we are forced to turn to the data on unemployment. These, like the data on employment, are not all equally suited to the present needs, and some have proved quite useless. The necessity of using homogeneous data in order to secure significant findings renders valueless, for the purpose in hand, the voluminous "surveys of employment," conducted on many occasions during the past forty years by various public, quasi-public, and private bodies. These surveys relate to widely different times, industries, localities, etc., and form a mass of evidence so heterogeneous in nature and merit as to contribute nothing to the present study, even as an occasional check.

Another set of data which was tested but found of no value in the present investigation is the monthly series collected by the American Federation of Labor throughout the decade 1899–1909, from unions embodying a membership between 40,000 and 170,000. The precise reasons for the inadequacy of this series are not perfectly clear,[18] but the fluctuations between successive months are of such a violent and erratic character as to suggest the unreliability of the series, not only as a measure of the absolute volume, but even as an index of relative variations of unemployment. President Gompers finally became convinced of the unreliable character of the A. F. of L. returns on unemployment,[19] and discontinued their collection.

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[16] See below, pp. 33 f., for further criticism of the Massachusetts data. A group of materials related to these employment series is the mass of reports made by public employment bureaus, as to positions offered, applied for, or filled. The career of public employment bureaus in this country is comparatively short; moreover, the authorities administering them have differed widely from one another in statistical definition and reporting practice, and the number of offices concerned varies greatly. Data of this kind were found, upon test, to be of little value for pre-war or post-war years. The lack of homogeneity over a moderately extended period destroys the usefulness of the data.

[17] See Section VII of this paper.

[18] The reasons for the defectiveness are much obscured by the scantiness of the descriptive matter given by the *Federationist* in its discussions of the subject. Nothing is said, for example, of such important matters as the industrial and geographical composition of the reporting unions. In large measure, however, the defects are probably due to inadequate statistical attention to the following matters: (1) the setting-up of a representative system of reporting units, (2) insistence upon regularity in reporting, (3) the elimination of labor dispute "unemployment," (4) the checking up of doubtful reports, through field agents.

The unemployment returns collected prior to June 1916 by the Bureau of Statistics and the Industrial Commission of New York state show a much higher order of merit,[20] though even here defects were discovered which only a considerable amount of statistical analysis was able to eliminate. These New York data were clearly superior to all others for the present purpose, and they were consequently chosen to represent the course of employment cycles before the war.

The New York returns were of two kinds: one set was collected at semi-annual intervals [21] from 1897 through 1913 from practically all the unions in the state, embodying 300,000 to 600,000 members. This set has been thrown into annual form by simple averaging, and used as the basis for an annual index of employment. The other set was collected at monthly intervals, from 1902 to 1916, from representative unions embodying 90,000 to 150,000 members, i. e. one-third or one-fourth of the total union membership of the state.[22] This second set has been used as the basis for a monthly and bimonthly index of employment. Figures are available which have made it possible to eliminate unemployment due to strikes, lockouts and disability from all monthly data, and from annual data beginning with 1899. Such elimination is a matter of great importance in studying the economic relationships of unemployment. Although in the long run, disputes were not so important a factor as the business cycle in creating unemployment, they frequently assumed such magnitude as to affect the unemployment curves markedly.

The trade groups most strongly represented in the New York series — both annual and monthly — were building; clothing and textiles; metals, machinery and shipbuilding; transportation; printing; and woodworking. The relative importance of these six major groups and the seven minor groups, in both the annual and the monthly series, is shown for selected years in Table 4.

IV. AN ANNUAL INDEX OF UNEMPLOYMENT COMPARED WITH PRODUCTION, 1899–1913

Chart 4 shows the annual unemployment index for all groups combined and for three leading groups singly: (1) metals, machinery and shipbuilding, (2) building and stone-working, and (3) clothing and textiles.[23] The four curves show a marked tendency to move simultaneously, in the business cycles from 1899 to 1913. In each of the curves the several depressions bear nearly the same relation to each other, in severity, as they do in either of the other curves. Noteworthy exceptions to this are the especially pronounced reaction shown in the clothing and textile industry between 1899 and 1901, and in the iron and steel industry between 1910 and 1911. The several industries appear to have differed from

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[19] He stated his opinion in testimony before the House Committee on Labor, April 1916. See House of Representatives, 64th Congress, 1st session, *Hearings before the Committee on Labor on House Joint Resolution 159*, p. 62.

[20] Another good unemployment series has been published since March 1908 by the Massachusetts Bureau of Labor Statistics. The series is well planned, covers two-thirds or more of the trade unions of the state, and extends to date. It has, however, proved to be of importance only as supplementary evidence in the present study. The series is reported only at quarterly intervals, and covers a rather short pre-war period; furthermore, Massachusetts is, on the whole, only half as important as New York as a key state in American industry. The value of the series will be much increased if Mr. Roswell F. Phelps, the Director, is successful in his efforts to obtain reports regularly in monthly form from representative unions.

[21] From 1897 through 1903 the reports were actually collected quarterly, but in order to ensure comparability semi-annual figures were used throughout 1897–1913; they refer to the last working day of March and of September.

[22] The monthly and semi-annual data were gathered from the *Annual Reports* of the Bureau of Labor Statistics, from the *Special Bulletins* of the Industrial Commission, and from unpublished figures which Messrs. Eugene B. Patton and Leonard W. Hatch kindly placed at the disposal of the writer for analysis.

[23] The method of analysis was as follows:

(1) a straight line was fitted to each series, to represent its secular trend over the period as a whole;

(2) the percentage deviations of each series from its line of secular trend were computed;

(3) the standard deviation of the percentage deviations of each series was computed, to measure the elasticity with which each series responds to business booms and depressions;

(4) the percentage deviations of each series were divided by the corresponding standard deviation, in order to standardize the elasticity of all the series, and thereby facilitate comparisons between series.

TABLE 4. — INDUSTRIAL COMPOSITION OF UNION MEMBERSHIP REPRESENTED IN (*a*) ANNUAL AND (*b*) MONTHLY INDICES OF UNEMPLOYMENT IN NEW YORK STATE

(*Unit: one per cent*)

	1902		1906		1910		1914	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
All trades	100	100	100	100	100	100	100	100
Building, stoneworking, etc.	28	31	35	32	26	26	24	24
Transportation	11	11	16	18	14	12	13	16
Clothing and textiles	15	15	9	8	26	28	34	33
Metals, machinery and shipbuilding	16	12	10	10	8	9	6	6
Printing, bookbinding, etc.	6	10	7	8	6	6	6	5
Woodworking and furnishing	4	3	4	3	2	3	2	2
Food and liquors	4	4	4	4	4	4	3	3
Theatres and music	2	1	3	2	2	1	1	1
Tobacco	3	2	3	3	2	3	1	2
Restaurants, trade, etc.	2	2	2	3	2	3	2	2
Public employment	3	2	2	2	4	2	3	3
Stationary enginetending	..	..	4	3	3	2	2	2
Miscellaneous	5	2	3	3	2	1	2	1

one another more widely in their response to the depression of 1911 than to other depressions.

Among all the industries, the one which registered most typically the movements of employment in all industries combined was the group known as metals, machinery and shipbuilding. This fact may be seen not only in Chart 4 but also in Chart 5. The correlation coefficient between employment in the metals group and the combination of all groups *excluding metals* is +90 per cent. The peculiarly intimate correspondence between the iron industry and manufacturing industry in general has of course been long maintained, chiefly on the theoretical ground that iron lies at the economic foundation of any industrialized community; but a positive demonstration is only beginning to be achieved. Recently Professor Edmund E. Day showed an extraordinarily close correspondence between his indices of production for the iron and steel industry and for all manufacture excluding iron and steel. Again, Mr. Edwin Frickey showed

CHART 4. — ANNUAL INDICES OF EMPLOYMENT IN NEW YORK STATE

(*Annual cycles*)

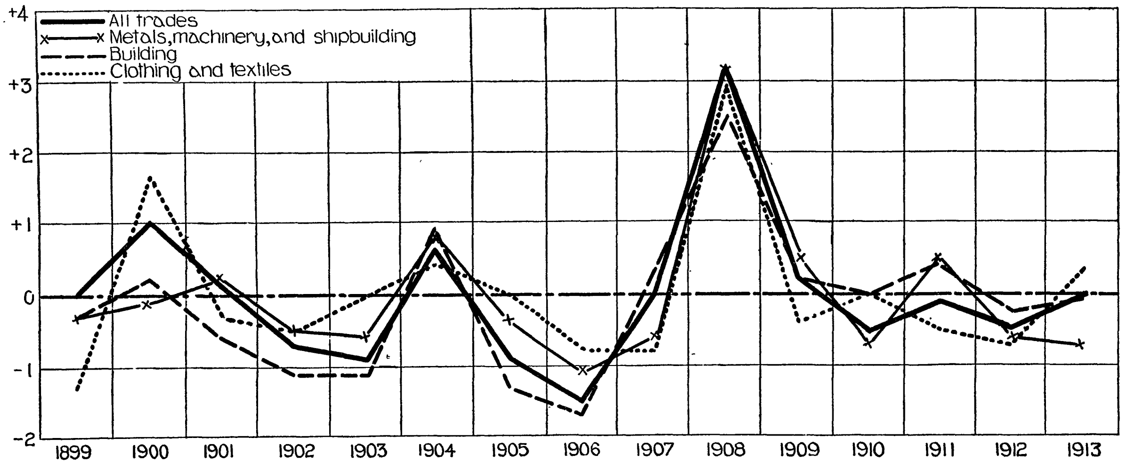


Table 5. — Corrected Annual Cycles of Unemployment in New York State

(*Unit: one standard deviation*)

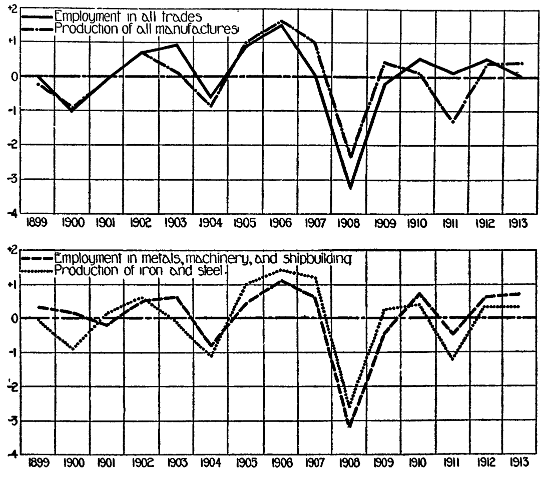
	All groups	Building	Metals, machinery and shipbuilding	Clothing and textiles
1899	0	− .3	− .3	−1.3
1900	+1.0	+ .2	− .1	+1.6
1901	+ .1	− .6	+ .2	− .3
1902	− .7	−1.1	− .5	− .5
1903	− .9	−1.1	− .6	0
1904	+ .6	+ .9	+ .8	+ .4
1905	− .9	−1.3	− .4	0
1906	−1.5	−1.7	−1.1	− .8
1907	0	+ .3	− .6	− .8
1908	+3.2	+2.5	+3.2	+2.9
1909	+ .2	+ .2	+ .5	− .4
1910	− .5	0	− .7	0
1911	− .1	+ .4	+ .5	− .5
1912	− .5	− .2	− .6	− .7
1913	0	− .1	− .7	+ .3

a similar relation between his new index of security prices for iron and steel companies and for twenty mixed industrials combined. These findings based upon physical production[24] and security prices strongly confirm the independent demonstration based on employment data.

Cycles of employment[25] and production are compared in Chart 5. Evidently the cycles of employment and production, for all groups combined, agree very closely; the correlation coefficient is +84 per cent. The correspondence is close, not only in the timing but also in the relative violence of depressions, compared with booms. Both indices drop sharply and decisively, but only for a brief period, during depressions; during booms, production and employment show a sustained movement at a moderately high level. This feature is not due to accident but to the essential properties of employment and production. It is easily seen that the numbers employed can be cut drastically during a depression, whereas during a boom new labor can be obtained only with difficulty. Production resembles employment in this respect, because not only labor but also physical capital is a potent factor limiting production during a boom. Serious difficulties attend a rapid or substantial expansion of plant, or the construction of new machinery. In short, when business is active, increase in either employment or production is limited by powerful physical factors, while a diminution of employment or production may be accomplished much more swiftly and effectively. It is natural, therefore, that the employment and production indices show long and moderate crests, but deep and narrow troughs.[26]

Chart 5. — Annual Indices of Employment (Unemployment Inverted) and Production Compared

(*Annual cycles*)



An equally close agreement appears when we compare employment in one of the most important industrial groups of New York state — metals, machinery, and shipbuilding — with the production of iron and steel. Again the correlation coefficient is high (+85 per cent). That these two indices should agree so well, notwithstanding the wide differences in the character of the series, affords strong confirmation of both the employment and the production indices.[27] Both record the pulse of industrial activity, though in wholly independent ways.[28]

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[24] *Review of Economic Statistics*, preliminary volume 2, p. 367, December, 1920. The coefficient of correlation was + 85 per cent, 5 per cent lower than that between the two employment curves. Compared with production in all lines including itself, iron and steel production showed a coefficient of + 98 per cent.

Review of Economic Statistics, preliminary volume 3, p. 266, August, 1921; also see the article by Professor Warren M. Persons, bringing together some of the published data on the iron and steel industry, preliminary volume 3, pp. 378–383, December, 1921. Professor Persons also introduces commodity prices into the demonstration (*loc. cit.*, pp. 379, 380). The findings based on employment have not appeared except in the present article.

[25] The corrected cycles of unemployment have been inverted so as to represent employment and afford easier comparison with the cycles of production.

[26] Stating the same feature in other terms, the unemployment percentage has greater room for fluctuation in an upward than in a downward direction. The percentage unemployed can conceivably increase as high as 100 per cent but naturally it cannot fall below zero. The average percentage unemployed over an extended period is of course less than 50 per cent, leaving a narrower zone for fluctuation downward toward zero, than upward toward 100 per cent.

The high order of correspondence between employment and production cycles gains added significance from a review of the statistical differences between the two series. First, the two groups of material emanate from sources of an entirely different character — production data from governmental bureaus, trade and manufacturers' associations; employment data from trade union secretaries. Second, the production data cover the output throughout each year, while the employment data are based on only two samplings in each year — March 31 and September 30. Third, the indices differ in their industrial composition. The industries which are represented in both kinds of data are represented by unequal weights, and in each kind are included industries which are wholly unrepresented in the other; e. g., the building industry, for which employment data but no production data are available.[29] Also, the employment data cover in general more advanced stages of manufacture than do the production data, even in the industries included in both; because at advanced stages units of output are so complex that few production series are available, as in the case of machinery in contrast to crude iron and steel. The employment index actually includes some industries which produce not physical goods, but services, for instance transportation, restaurants, retail trade, theatrical and public employment. Finally, the indices differ markedly in geographical distribution, since they cover production in the entire United States, but employment in only one state.

Although these statistical considerations make somewhat surprising the close agreement of the employment cycles in New York with production cycles in the entire United States, considerations of the economic position of New York state seem to explain why the New York index serves as a fairly good index of production for the United States. Since it is a good index of production in the United States it is still more probably a good index of employment in the United States.

V. THE REPRESENTATIVE CHARACTER OF NEW YORK DATA

New York is the premier state in many lines of economic activity. Of the 38,000,000 persons gainfully occupied in the United States in 1910, 4,000,000 or nearly 11 per cent were in New York.[30] The importance of the state in some lines of economic activity was slight: thus, in the extraction of minerals New York's quota was only 12,000 persons, or one per cent of the mining population of the United States, while in agriculture, forestry, and animal husbandry it was 379,000 or only 3 per cent. In other lines, however, its contribution to the aggregate was much greater — in transportation one-third of a million persons, or 12 per cent, and in trade a half million, or 15 per cent — while in the largest group of all, the manufacturing and mechanical industries, out of the $10\frac{1}{2}$ million persons who were engaged in the United States as a whole, over $1\frac{1}{2}$

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[27] Similar detailed comparisons for other single industries show less remarkable agreements: employment in woodworking and furnishing with production of lumber, +78 per cent; employment in the tobacco industry with production of cigars, etc., +60 per cent; employment in the clothing and textile (chiefly clothing) manufacture with production of textile piece goods, +50 per cent. The lower order of agreement in these cases is not conclusive evidence of a loose relationship between employment and production in comparable industries; in large measure it is due to the economic dissimilarity between the industrial groups represented in the New York employment data and their nearest counterparts in the production indices. If employment and production indices could be constructed for identical industries, the annual indices would almost certainly agree much more closely. Considering the statistical properties of the average, it is natural to expect a closer agreement between employment and production in general, than for component industries.

[28] It is impossible as yet to judge which kind of data probably gives the truer record of industrial activity. Among the important considerations are the greater geographical comprehensiveness of the production series, and the greater industrial comprehensiveness of the employment series. Another important advantage of the employment data is their availability in monthly form. This will be discussed presently (*infra*, pp. 32, 35) but even at this stage of our investigation it seems probable that employment like production forms a very satisfactory industrial barometer.

[29] Building permits do not constitute a measure of current building production; they tend rather to forecast future production by about a half-year, though not in a highly consistent manner.

[30] The sources of the data given in this paragraph are the Thirteenth Census of Population, vol. 4, *Occupation Statistics*, 1910, and the *Abstracts* for the Censuses of Manufactures taken in 1909 and 1914.

millions or 15 per cent were in New York state.[31] Nor did this relative importance of manufacturing in New York change materially during the fifteen years prior to the war; at the four censuses of 1914, 1909, 1904 and 1899 the percentages of wage earners, and also the total wages paid, varied between 15 per cent and 16 per cent of the total for the United States. The number of manufacturing establishments in New York was throughout the period 17 per cent; the total wages and salaries ranged between 15 and 16 per cent, and the value added by manufacture between 17 and 18 per cent. In short, the most important industries in New York state are manufacturing industries, in which the problems of unemployment and the business cycle are peculiarly important, and in this group the relative importance of New York to the country as a whole remained nearly constant, at about one-sixth of the total, a quota larger than that of any other state and twice as large as that of Massachusetts. The relative position of New York in the manufacturing and mechanical industries, in transportation, and in trade is a consideration of great importance. It indicates that the economic activities within the state are of such a character as to make business conditions there sensitive to business cycles in the country as a whole.

The geographical location of New York with reference to the industrial region of northeastern United States, is perhaps even more significant than the actual quota of New York in the aggregate. The other states which contribute most heavily to the output of the country's manufactures are located in the neighborhood of New York. Second in rank to New York is Pennsylvania, which in 1914 furnished 12 per cent of the total value added by manufacture.[32] Next come Illinois with 9 per cent and Massachusetts with 8 per cent. Ohio supplies 7 per cent and New Jersey 5 per cent of the total. To the east of New York the great industrial centers of New England included in 1914 one-eighth of the country's manufacturing. In other words, two-thirds of the country's manufacturing is carried on in New York, New England, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin, and Michigan combined. New York is not only the leading state in industrial output, but it is situated almost at the heart of the industrial section of the United States.

Furthermore, New York stands at the gateway through which flows most of the country's import and export trade. The large majority of immigrant laborers enter the country through the port of New York, and have tended to settle in the East. Rich supplies of coal and iron are situated near by. Markets and sources of raw materials within the country are readily accessible by way of the highly developed network of railroads and coastwise steamship lines converging at New York City, and by way of the Hudson River, the canals, and the Great Lakes into the Northwest.

This general view of the economic importance of New York state, and of its geographical relations to the rest of the country, indicates that industrial conditions in New York ought to react fairly sensitively to conditions elsewhere, and should possess a peculiarly representative character. It seems justifiable, then, to look upon the unemployment index for New York as fairly representative of industrial unemployment in the country as a whole.

VI. A MONTHLY INDEX OF EMPLOYMENT IN NEW YORK STATE
1903–16

The characteristics exhibited by the annual index of unemployment, coupled with the facts just presented concerning the representative character of industry in New York, suggest the desirability of constructing a monthly index of employment from data for that state. A monthly index has important advantages over an annual index. In particular, an annual index obscures time relationships which the use of shorter time units may disclose.

The monthly percentages of unemployment collected by the New York Bureau of Labor Statistics are similar in nature to the annual figures already presented. Although they relate to only one-third or one-fourth the total number of union members in New York state, the unions which made these returns were carefully selected by the Bureau. Attention was given to the distribution by industry, by locality and by size of union, and the selection appears to be truly representative of the larger mass. The monthly returns cover the period from January 1903 to June 1916.

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[31] In other major groups also the proportion was high: in professional service 13 per cent, in domestic and personal service 14 per cent, and in clerical occupations 19 per cent.

[32] Data on the manufacturing activity of the several states are taken from the U. S. Census of Manufactures, 1914, *Abstract*, p. 272.

In addition to the cyclical unemployment, in which we are primarily interested, four other elements are present in the original data: the figures contain unemployment connected with (1) disability, (2) labor disputes, (3) secular trend, and (4) seasonal variation. The cyclical element may be isolated by eliminating these four extraneous elements from the original data — the first two by subtraction, the third and fourth by more refined statistical methods.[33] In isolating cyclical unemployment, we obtain, as a by-product, a picture of these minor movements alone. Several of them are of enough interest to justify separate discussion.

Disability includes old age, sickness and invalidity, and as might be expected presents no marked fluctuations. The percentage of unemployed owing to these causes was small and regular, ranging generally between one and two per cent. This element was nevertheless eliminated from all unemployment data used in this study.

Labor disputes, on the other hand, were frequently the cause of considerable unemployment. It is true that on the average the unemployment due to labor disputes was not extremely serious, but at sporadic intervals it became very great, especially in 1903, 1910, 1913, and 1916, and to a lesser degree in 1904 and 1909. Moreover there was a tendency for unemployment due to disputes to vary inversely with that due to other causes: on the occasions when labor disputes became important, the unemployment due to other causes was generally slight, and *vice versa.* This was due partly to incompleteness in the record of unemployment actually attributable to disputes, but primarily to the tendency of disputes to wane in importance during business depressions, and to increase when employment conditions improve again. Such opposing movements would naturally have the effect of partially filling in the hollows and smoothing off the peaks of the unemployment curve, and would partly obscure the cyclical movements with which we are primarily concerned. The element of disputes was therefore eliminated before obtaining cycles of unemployment, not merely in the building and clothing industries, in which labor disputes caused most disturbance, but in all others as well.

These two extraneous elements, disputes and disability, were on the whole considerably less important than other causes combined. Unemployment due to these other causes showed (1) a long-time "tilt," or *secular trend;* (2) a *seasonal fluctuation;* and (3) a pronounced *cyclical swing* about the line of trend. Of these only the second and third types are of interest here.[34]

The *seasonal variation*[35] of unemployment is significant, because it presumably indicates with considerable accuracy the seasonal variation in industrial activity and production, within the industries covered.[36] Data for these industries are presented in Table 6. In some of the industries represented, employment is somewhat more plentiful in the summer months, and comparatively scarce in the late autumn and the winter. Such are iron and steel, building, woodworking and furnishing, and in addition the *ensemble* of all industries represented in the unemployment data. Another group, comprising railways, clothing and textiles and printing, have a season of comparative inactivity in the spring or summer. In two of these — clothing and printing — two peaks may be observed, one in the spring and the other in December. The inactivity in winter is less severe than that in the spring for printing, but somewhat more so for clothing and textiles.

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[33] The methods used were substantially those devised by Professor Warren M. Persons, and presented in the *Review of Economic Statistics*, preliminary volume 1, January and April, 1919.

[34] As for the secular trend, one might expect from the nature of the "percentage unemployed" that over a period of twelve or fifteen years the trend would be neither upward nor downward, but horizontal. Such was not precisely the case with these indices for the period 1903–14. In some of the industries analyzed, as furnishing and woodworking, it was nearly horizontal, in printing and railroading it was downward, but in most cases it was upward, as in the iron and steel group, in building, and in the clothing and textile group. The interpretation of these long-time trends is extremely difficult, if not impossible. One must not jump to the conclusion that the volume of unemployment was actually growing in most industries, and declining in the printing industry. Several considerations must be borne in mind. During the period under consideration the industrial composition of the groups was gradually changing, labor disputes were bringing about an increasing amount of indirect unemployment, and with the spread of unionization many semi-skilled and unskilled workers were being incorporated in the returns. By "indirect unemployment" is meant *bona fide* unemployment of non-participants in the disputes, thrown out of work because of lack of material, etc., resulting therefrom. These are only a few of the factors which probably helped to tilt the trend, and doubtless the relative importance of these contributory factors, varied between industries. It is important to observe, however, that whatever may be the causes of these trends, they are of no importance here, because our purpose is to study merely the fluctuations about the trend.

[35] The method used for measuring seasonal variation is that devised by Professor Persons; see the REVIEW for January, 1919, pp. 18 ff. Only one modification was introduced; in the case of the clothing and textile series the arithmetic average of the three central link relatives was used as typical of the month-to-month fluctuations instead of the median link relative. This method for measuring seasonal variation is superior to any previously devised, for it eliminates the secondary effect of trend on the apparent seasonal variation. Such a method as averaging the percentages unemployed in all Januaries, in all Februaries, etc., a method used by such eminent writers as Bowley and Beveridge, tends to leave in the result a "tilt" not truly due to seasonal variation at all. It also tends to exaggerate the extreme fluctuations more than does the use of the median link relative.

TABLE 6. — ADJUSTED INDICES OF SEASONAL VARIATION OF UNEMPLOYMENT IN LEADING TRADES IN NEW YORK STATE

(*Average for year = 100 per cent*)

	All trades	Iron and steel	Railways	Building and paving	Clothing and textiles	Woodworking and furnishing	Printing and bookbinding
January	145	120	79	167	96	128	86
February ...	136	112	93	155	95	125	91
March	132	101	62	150	108	126	94
April	96	104	119	97	116	118	118
May	92	92	114	85	122	103	121
June	90	80	121	78	104	99	122
July	83	83	124	67	60	88	83
August	74	94	127	61	59	89	84
September ..	62	101	90	53	91	83	91
October	66	103	93	71	106	71	99
November ..	84	96	86	88	106	74	103
December ..	140	115	91	128	139	96	109

Cycles of unemployment. We have now considered, successively, the nature of the variations in employment due to various other causes than the business cycle. The next step is to isolate those movements ascribable to the business cycle alone. The central question here involved is this: how do the leading industries compare with one another as to their timing, i. e. the concurrence or lead or lag of the industries with respect to one another? Do certain industries tend characteristically to react before or after certain others in their response to business booms and depressions?

The preceding analysis has disclosed marked differences among the industries in some respects, but the six chief industries show in their timing a remarkable similarity, according to the corrected bimonthly indices in Chart 6.[37] No industry shows any clear tendency to precede or to follow the others systematically. Consider first the *peaks* of unemployment. In each depression some one industry attained its peak of unemployment slightly earlier than the others, but the relationship of the curves is not systematic. Apparently the clothing, textile and building trades experienced the depression of 1903–04 comparatively early in 1903 and began to recover in the first quarter of 1904. In 1908 the railway and telegraph industries reached maximum unemployment a trifle before most other industries; in building there seems to have been two peaks, one a month earlier, the other a few months later, than in the other industries. The mild depression of 1911 apparently was not felt equally by all industries. Of those which were appreciably affected, building witnessed maximum unemployment earlier, and woodworking later, than the average. Aside from these minor variations, however, the six industries experienced the maxim of unemployment at nearly the same time. In considering periods of active business — low unemployment — time sequences cannot be traced with as much precision as during depressions, since in active times the movement of the curve is not short and sharp as it is during depressions.[38] The course of the unemployment curves during the booms of 1905–07, 1910 and 1912–13, as during depressions, shows on the whole a fair unison in timing among the six industries analyzed. In a few cases, notably wood-

[36] The applicability of these seasonal indices to areas other than New York state varies, of course, from industry to industry. Thus an outdoor industry like building would certainly be far less subject to seasonal fluctuations in a region of lower latitude where temperature, snowfall, etc. would interfere less with winter operations.

[37] Bimonthly rather than monthly cycles are shown in Chart 6, in order to lessen erratic fluctuations from month to month and thereby facilitate visual comparison.

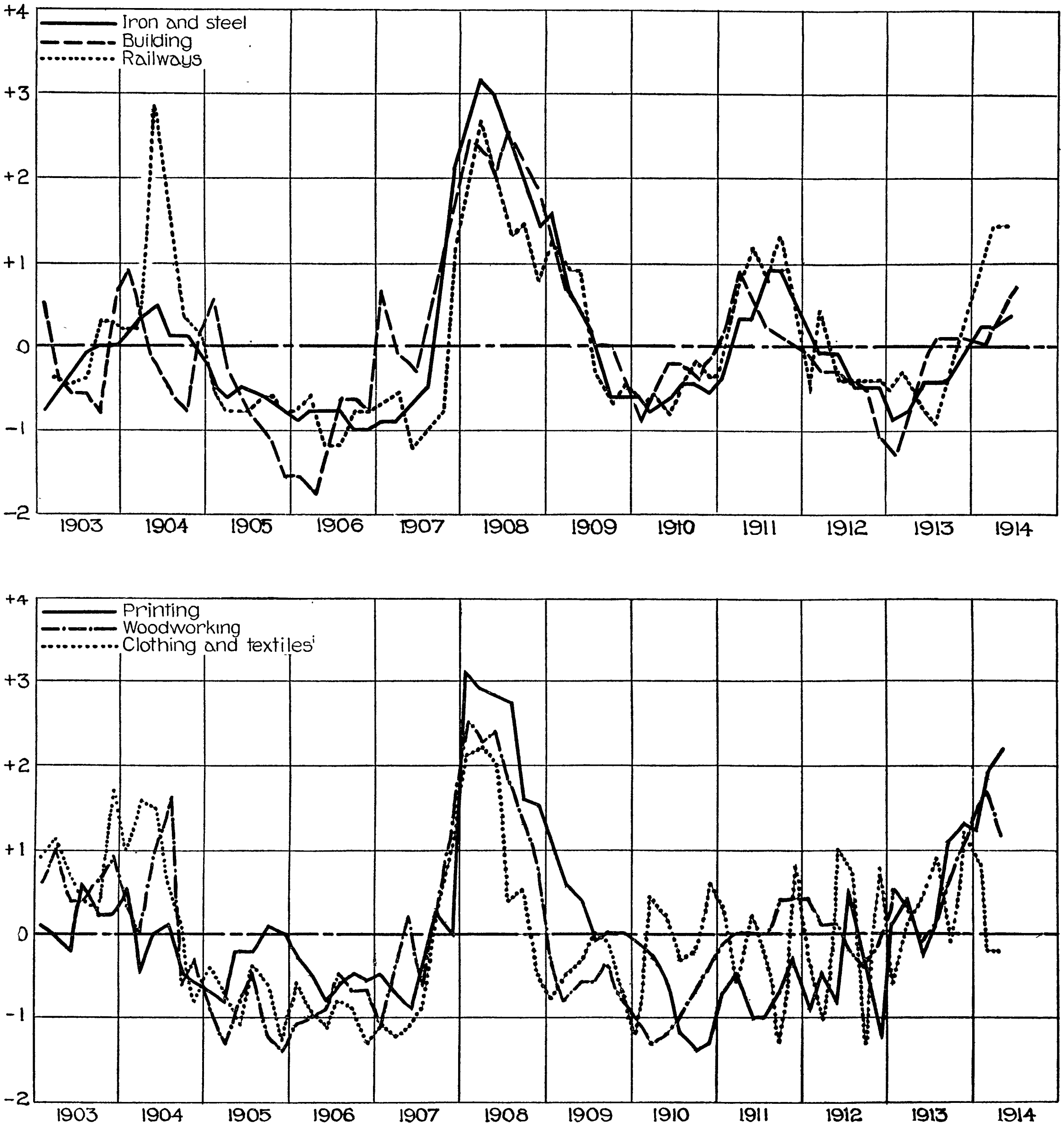
These six groups constitute a large majority of the numbers represented in all thirteen groups.

[38] This feature has also been disclosed in the annual indices of both employment and production. *Supra*, p. 24.

working in 1905, building in 1906, and perhaps clothing and textiles in 1910, a tendency to lead may be observed, but it is not a regular tendency.

Chart 6. — Unemployment in Leading Trade Groups of New York State

(*Bimonthly cycles*)



Judged by correlations between the series, there is again some evidence that certain industries, particularly clothing, textiles, woodworking, furnishing and others, tended to precede, and printing to lag. In Table 7 are shown the correlation coefficients for every possible pairing among the six series for (*a*) a lead of two months, (*b*) concurrent items, and (*c*) a lag of two months. The best correlation was in 5 or 6 cases[39] for concurrent items, in 9 or 10 cases either a lead or a lag of two months. Considering clothing

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[39] One of the fifteen best fits was doubtful, lying between concurrence and a lead (or lag) of two months.

TABLE 7. — SUMMARY OF INTER-SERIES CORRELATION COEFFICIENTS: UNEMPLOYMENT IN SIX INDUSTRIES IN NEW YORK STATE

(*Unit: one per cent*)

Standard series	IRON AND STEEL			BUILDING			RAILROADS			CLOTHING			PRINTING			WOOD-WORKING			SUMMARY OF BEST FITS		
	Lag 2	0	Lead 2	Lag 2	0	Lead 2	Lag 2	0	Lead 2	Lag 2	0	Lead 2	Lag 2	0	Lead 2	Lag 2	0	Lead 2	Lag 2	0	Lead 2
Iron and steel .	..	..	..	79	84	84	82	85	74	44	50	54†	75	73	70	67	73	75	1	1 or 2	2 or 3
Building	84	84	79	..	..	..	73	67	57	54	47	45	64	66	61	61	64	65	2 or 3	1 or 2	1
Railroads	74	85	82	57	67	73	..	..	..	43	51	56	54	58	57	60	70	69	..	3	2
Clothing	54*	54	44	45	47	54	56	51	43	..	..	..	56	43	37	60	71	58	3	1	1
Printing	70	73	75	61	66	64	57	58	54	37	43	56	..	..	..	53	69	70	..	2	3
Woodworking .	75	73	67	65	64	61	69	70	60	58	71	60.	70	69	53	..	..	..	3	2	..

* Lagging 4 months, $r = +52$.
Lagging 6 months, $r = +42$.

† Leading 4 months, $r = +52$.
Leading 6 months, $r = +42$.

and textiles as a standard (Table 7, last column, "Summary") we see that one correlative series preceded it by two months, one moved concurrently and three lagged two months. With reference to woodworking, two series moved simultaneously and three lagged two months. Printing was unlike clothing and woodworking: two series moved concurrently, but three preceded it. Building seems to fall into the group of "leaders," iron and steel among the "laggers," both by a slight margin. Indeed the tendencies to lead or to lag are in no case perfectly clear. Neither visual nor mathematical intercomparison of the six curves gives conclusive evidence of a lag or lead except on particular occasions. In the main, the evidence indicates: (1) that in booms and in depressions the six industries passed the critical turning points at times only a few weeks or months apart and (2) that none of the six industries preceded or followed the others systematically, and by a decisive margin.

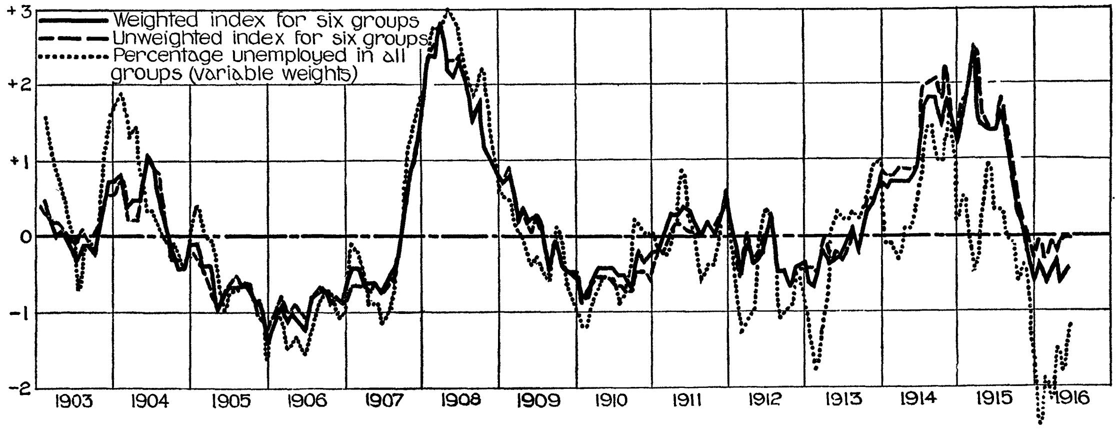
Careful comparison of the curves in Chart 6 will disclose in some of them certain erratic fluctuations, apparently not due to business cycles, but to extraneous impulses. Markedly erratic movements were confined chiefly to two groups, building and the manufacture of clothing and textiles, and in practically every case were due predominantly to labor disputes. Sometimes the number thrown out of work because of actual participation in a dispute seems to have been incompletely reported, notwithstanding the precautions taken by the Bureau of Labor Statistics to forestall this in cases of possible irregularity, through audit of the data by office and field clerks. Efforts were made to indicate also those out of work owing to the indirect effect of disputes, but despite the precautions taken it seems probable that certain peaks of unemployment were to a large extent the indirect effect of disputes, due to the throwing out of work of those whose supply of materials depended on the output of related trades in which disputes were taking place.

No data exist which make possible an accurate appraisal of the importance of these two factors. However, the fact that they do appear is highly important, because the two industries in which erratic movements chiefly occur are of prime importance (see Table 4). Clothing and textile manufacture for example included, during the later years of the period, one-third to one-half as many workers as were represented in the other eleven groups combined. Although this industry was not preponderant to such a degree throughout the entire period, it attained its supremacy very rapidly after 1909. This was precisely the period during which disputes became rampant in that industry; indeed unionization and labor disputes were, doubtless, related facts. In any case the heavy weight of the clothing and textile industry in the aggregate tends to introduce in exaggerated form the erratic fluctuations chargeable — directly or indirectly — to labor disputes in that industry. Moreover, it tends to distort the seasonal variation of the aggregate, making this resemble its own seasonal variation more nearly in the later years than before, so that the measurement and complete elimination of the true seasonal variation in "all trades combined" is made impossible. How important an influence is exerted on the movements of the general unemployment curve may be seen by comparing the dotted curve in Chart 7 with the clothing and textile curve in Chart 6. Clearly this single industry exerted so powerful an influence in the later years as to distort very seriously the form of the general curve.[40] To secure a reliable index of cyclical employment in general, it is imperative that we control the variable and spuriously heavy weighting of the building and clothing and textile industries.[41]

How shall we correct for these cross-currents in the unemployment cycles for certain industries? No data exist for eliminating them completely from the single series; the known unemployment due, either directly or indirectly, to strikes and lockouts, has already been eliminated. It is possible, however, to make a combination in such a way as to prevent the two dispute-ridden industries from overwhelming the others in the composite record of unemployment cycles from 1903 to 1916. Instead of allowing each of the groups a weight dependent upon its current membership, month by month — as is done implicitly in relying upon the "percentages unemployed in all groups combined" — each of the six industries is assigned a fixed weight, proportional to its importance over the period as a whole.

CHART 7. — GENERAL INDICES OF UNEMPLOYMENT IN NEW YORK STATE

(*Monthly cycles*)



Four criteria were considered in determining the correct weights for the several industries:

(1) the mean membership of the representative unions upon which the monthly returns were actually based (average 1903–13)

(2) the mean membership of all the unions in the state (average 1897–1913)

(3) the number of all workers (union and non-union) in New York state occupied in these industries according to the United States Census of Occupations (1910)

(4) the number of all workers (union and non-union) in New York state, employed in these industries, according to the United States Census of Manufactures taken in 1909, the census year nearest the middle of the period covered by the monthly New York returns.

Of these criteria, the last two are more comprehensive than the first two, because they include non-union as well as union workers. The fourth is less inclusive than the third, however, because it represents very inadequately, or not at all, the non-manufacturing groups — building, transportation, etc. — and consequently it was not utilized. The first, second and third systems of weighting were found to agree fairly well. According to the consensus of the three systems, metals, printing, and woodworking ranked least in importance and were weighted one point apiece, transportation and clothing ranked about twice as important as the first and were weighted two points apiece, building ranked three times as important and was weighted three points, making a total of ten points.

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[40] Still another objection is that the cotton industry is affected by cycles of its own, caused by fluctuations of the cotton crop.

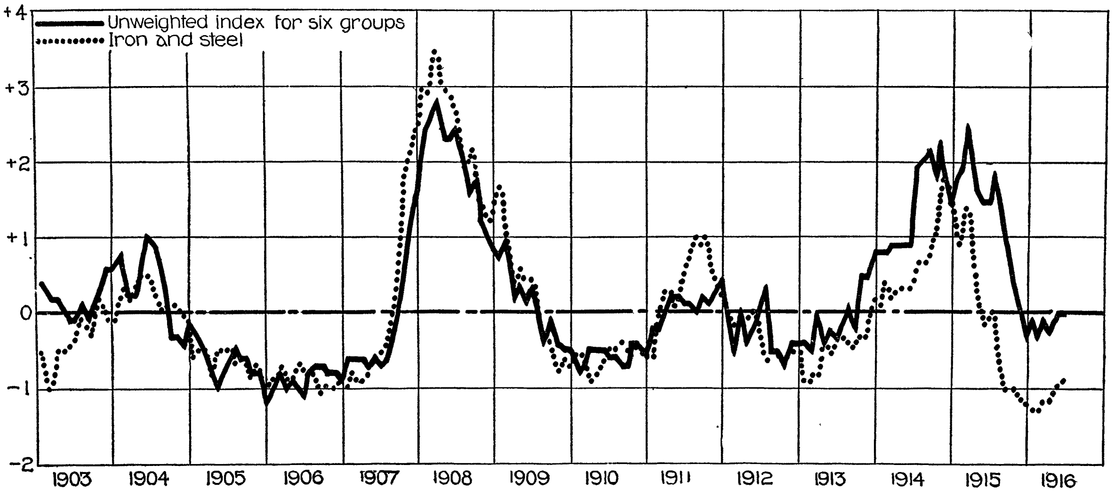
[41] The New York Bureau committed its only serious mistake when it failed to introduce a control into the actual unemployment data, by keeping a standard set of reporting unions for the clothing and the building trades, limiting the numbers incorporated into the result.

The result of the use of fixed weights for the several groups is indicated by the full line in Chart 7. The dashed line in the same chart represents the "unweighted" average, that is a combination of the six trades assigning identical weights to each. The waves of unemployment due solely to business booms and depressions stand out clearly in both curves: dullness in 1903, depression in 1904, improvement in 1905, intense activity in 1906–07, depression in 1908, activity in 1909–10, minor depression in 1911, improvement in 1912–13, incipient depression in 1913–14, recovery commencing in early 1915 and extending up to the period of uncertainty in early 1916. Manifestly the form of the general cycles of unemployment is nearly the same in both of the stabilized indices. Apparently accuracy of weighting is of very slight consequence, provided the weights be not allowed to vary capriciously during the period, owing to subtle influences such as the increase of membership in disputant trade groups. The crude "hit-or-miss" weighting of the original data dominates the dotted line, and causes it to differ widely from both fixed-weight indices. Evidently the difficulty which attended the use of the percentages of unemployment in "all trades combined" has been successfully overcome by the use of fixed weights; erratic fluctuations in 1903–05 due chiefly to building disputes, and in 1910–14, due to clothing and textile disputes, have been reduced or eliminated in both fixed-weight curves.

Having set up an index of unemployment based upon six industries, the question arises, whether the index agrees better with some components than with others. Does unemployment in some one industry tend to fluctuate in a manner fairly characteristic of unemployment in all combined? In answering this question, it would be unfair to compare the indices for separate industries with the weighted index, for the latter would reflect the movements in the industries which had the heaviest weights. Therefore the form chosen for comparison was the unweighted index in which all six industries were represented equally. Actual comparison of the unweighted index with the indices for each of the six industrial groups showed that railways and the building trade furnished fairly reliable barometers of general industrial activity, but that the

Chart 8. — Unemployment in Iron and Steel Trade and Unweighted Index of Unemployment in New York State

(*Monthly cycles*)



index for iron and steel fitted the unweighted index most neatly (see Chart 8). Not only is this disclosure in accord with the findings independently reached by Professor Day in his study of annual production data, and with the findings based on the annual unemployment data already presented,[42] but it enables us to go further, and show that the iron and steel index was an excellent register of general industrial activity, throughout the period 1903–16, in monthly as well as annual form. Such a demonstration could not be made from production data, because until recent years monthly production data for only very few industries were available.

VII. COMPARISON OF NEW YORK AND MASSACHUSETTS INDICES

This completes the presentation of the monthly pre-war index of unemployment, which inverted will serve as an index of employment for New York state, from 1903 to 1916. There seems to be good ground for regarding it as an index of industrial employment for the United States, not only because New York is the key state in American industry, but also because important evidence is available in support of the actual monthly unemployment index for New York state.

The findings presented in the preceding pages, based on monthly reports of representative unions, are in complete harmony with the cycles of annual employment data previously shown, based on all trade unions in New York state. When charted, practically every significant movement is quite as faithfully reflected by representative as by all unions, and the correlation coefficient is 96 per cent. This indicates that the smaller group of unions is a selection truly representative of the total mass, which is three or four times as great. If all employment fluctuated in a manner markedly different from that in the representative group, a more serious disagreement would certainly have appeared between the two sets of data.

Chart 9 shows that the quarterly percentages of unemployment in Massachusetts trade unions yield, when corrected for seasonal variation, etc., an index much like that for New York, after 1908 when the Massachusetts series was begun. The two differ in no essential except their unequal response to the depression of 1911. In Massachusetts unemployment did not become so severe as in New York, primarily because the iron and steel industry, which was especially hard hit by that depression, is more important in the latter state.

By use of a special device, the discontinuous *employment* data for Massachusetts[43] have been corrected, and thrown into a form which makes possible a rough comparison with the New York index. When thus adjusted, the employment index for manufacturing industries of Massachusetts fluctuates in cycles quite similar to those of New York.[44] Little can be said with assurance except as to the course of the cycle during single calendar years, because the method used, or any other method that could have been used for throwing these data into continuous form, entails an assumption as to the December-to-January change which in particular years may not accord with the truth. Like the inverted unemployment cycles for Massachusetts the corrected data on employment strongly corroborate the New York index. The agreement is close in all respects except the lagging recovery of 1904, and the more sustained movement in the first few months of 1907. The differences like the similarities between the curves need to be interpreted cautiously in view of the nature of the data upon which the adjusted curve is based.[45]

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[42] See *supra*, pp. 22–25.

[43] In addition the writer has worked out in some detail the analysis of the United States census data and the New Jersey Bureau data on employment, both of which afford valuable though disconnected supporting evidence as to the course of employment cycles. They are omitted here for lack of space.

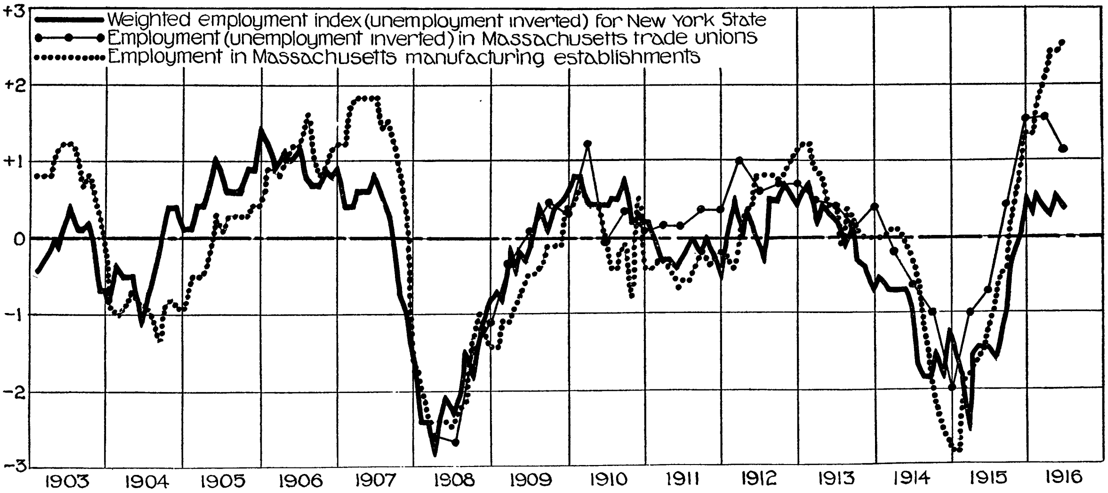
[44] Cotton was excluded because it is sensitive not only to business cycles but also to crop cycles, and, because the importance of this industry in Massachusetts would exaggerate the influence of the disturbing cross-currents thus introduced.

The method of analyzing the Massachusetts data consisted of using the month-to-month link relatives to describe the course of employment within the calendar year, and assuming that in the gap from each December to the following January the only forces affecting employment were simply the normal seasonal variation and trend, the business cycle being considered momentarily inoperative. The "normal" variation was determined by the median $\frac{\text{January}}{\text{December}}$ link relative from 1890 to 1905, when data on a comparable basis were available. On this hypothesis it was possible to construct tentatively a continuous index, adjusted to the 1909 Census of Manufactures, and representing approximately the aggregate number employed in all manufacturing establishments in Massachusetts, with the exception of those in the cotton industry. The secular trend and seasonal variation were then eliminated in the usual way.

The analysis of the *unemployment* data for Massachusetts required a special modification of Persons' method; since they did not begin until 1908, the secular trend would have been distorted by use of that method unmodified. The modified method assumed that in each year the ratio of the probable average ordinate of secular trend, to the average of the actual items for Massachusetts, was the same as the corresponding ratio normal in the New York unemployment series; to the probable values thus determined a straight line was fitted. The usual method was followed from this point. Evidently this modification does not introduce a spurious element into the time relations between the corrected New York and Massachusetts series; any marked time differences usually existing would have been fully disclosed even though the data for New York were used as an aid in determining the probable secular trend of those for Massachusetts.

CHART 9. — COMPARISON OF NEW YORK AND MASSACHUSETTS EMPLOYMENT INDICES

(*Monthly and quarterly cycles.*)



Another type of supporting evidence as to the reliability of the New York index as an index of employment in the United States may be found in its close agreements with wholly independent series long known to represent the activity of business in the country. Let us now turn to these comparisons of the employment index with business indices.

VIII. THE RELATION OF EMPLOYMENT TO THE BUSINESS CYCLE IN THE UNITED STATES, 1903–14

The following exhibit serves a twofold purpose. It demonstrates how far the index of employment serves as an industrial index, through its close agreement with other business indices of a different character. It also shows the relationships between employment as such and certain other phases of the business cycle: prices, production, speculation, etc. The series compared are selected from those analyzed by Professor Persons, and presented in previous issues of the REVIEW.[46]

Of all the series thus far analyzed, that which manifests the closest agreement with employment is pig-iron production. In fact, employment and production agree with each other, statistically, better than do any other two independent indices now known; the coefficient of correlation is +85 per cent for simultaneous items.[47] This is

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[45] Mr. Ralph G. Hurlin, statistician of the Russell Sage Foundation, is apparently willing to place much more reliance upon a combination of these discontinuous data than the present writer feels is justified. See the *Annalist* for October 24, 1921, p. 387.

[46] See the REVIEW OF ECONOMIC STATISTICS, preliminary volume 1, January and April, 1919.

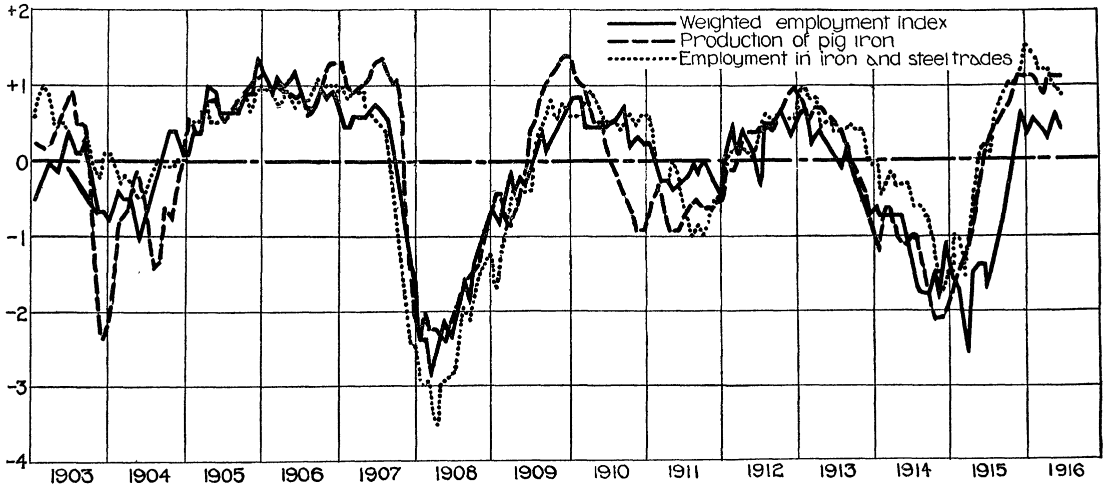
[47] With pig-iron production leading by two months the coefficient is +73, and lagging two months +82 per cent.

Two of Professor Persons' pairings have higher coefficients, but the series paired are not independent. The correlation between New York clearings and Dow-Jones' price index for industrial stocks is +.86, and that between New York clearings and Dow-Jones' price index for railroad stocks is +.87. In both cases the correlation is to a large extent spurious; that is, stock prices themselves form so large an element in the value of New York clearings as to destroy the significance of the correlation coefficient as a measure of independent agreement.

Even Bradstreet's price index, the series adopted by Persons as the primary standard of reference, does not agree with not due to any mere coincidence, but to fundamental economic reasons. Professor Day has proved already that pig-iron production represents very accurately cycles of production in general, as represented in annual series. Furthermore, the employment index in annual form has been shown to agree very closely with Day's index for the production of manufactures from 1899 to 1913. The results of the two independent studies now support each other again, this time with reference to monthly movements. This new result is significant chiefly because the agreement of the indices in monthly form enables us to trace the course of industrial activity with far more precision than would be possible otherwise. The extreme dearth of monthly production data in the pre-war period prevents the construction of any general index of production in monthly form, and the wisdom of relying upon pig-iron alone as a monthly index for all manufacturing would be questionable, notwithstanding the agreement of the annual indices of pig-iron production and of production in general. The fact that pig iron stands at so early a stage of manufacture would weigh heavily against the use of pig-iron production as a general register of production. Studied in the shorter time intervals, pig-iron production might fail to register current production in other lines — monthly variations might for instance precede the course of production in more advanced stages. Indeed just such a situation prevailed at times, according to Chart 10; pig-iron production did precede the composite employment cycles at critical points in 1908, 1910, 1911 and 1913. Monthly employment in the iron and steel trades — which as already pointed out is a reliable index of employment in general — also lags after pig-iron production at these times, although the two were simultaneous at the turning point after the depression of 1914–15.[48]

Chart 10. — Employment (Unemployment Inverted) and Pig-Iron Production

(*Monthly cycles*)



Whether the employment index or pig-iron production is a better measure of general industrial activity is not wholly certain; yet a fairly definite answer can be given. It will be remembered that, in reviewing the annual indices of production and of employment, the former was shown to be the more comprehensive geographi-

any correlative as closely as do unemployment and pig-iron production, even when the price series is given the lead or lag which yields the closest fit:

Price of 20 railroad stocks (leading 10 months)	+.76
Pig-iron production (leading 2 months)	+.75
Imports (leading 2 months)	+.77
Railroad gross earnings (concurrent)	+.77
New York reserves (lagging 2 months)	−.78
4–6 months paper (lagging 4 months)	+.80

Review of Economic Statistics, April, 1919, p. 182

[48] The influence of the blast-furnace or pig-iron industry itself in the employment index for iron and steel is very small. Only a small fraction of the country's pig iron is produced in New York state, and practically all wage earners involved in this employment index were occupied at much more advanced stages of manufacture.

cally and the latter industrially, and the merits of the two as indices of industrial activity seemed nearly to balance. The situation is different with respect to the monthly indices. In this monthly form the advantage of the employment index is greatly strengthened, because the monthly production data represented are far less comprehensive, industrially, than the data used for the annual index of the volume of manufacture. Moreover, the advantage held by the annual index of the volume of manufacture — its greater geographical comprehensiveness—is here greatly weakened by the fact that pig iron is not produced widely but only in well-defined zones limited chiefly to a few states. In short, there seems a clear balance of evidence in favor of the monthly employment index as the more comprehensive index of the general volume of production except in agriculture and mining. If the corrected cycles of all industrial production from 1903 to 1916 could be known, the curve would probably lie in the zone indicated by the three curves of Chart 10, and probably nearest to the weighted employment index. Any inequality in the amplitude of employment as compared with production is eliminated by the process of correction used.

Not only pig-iron production but other series having a close economic relationship to business activity show a remarkably close statistical relationship to employment. These are bank clearings outside New York City, imports into the United States, and the number of business failures (cycles inverted). The price element is of course involved in all three of these measures of business, because clearings and imports are measured in value not in quantity, and because the number of failures naturally diminishes when prices rise even without increase in the physical volume of business done. The relative influence of the price element as compared with the element of physical volume in affecting the form of these correlatives cannot be determined with accuracy as yet, but there seems to be ground for believing that prices are considerably less important than physical volume.[49] Employment fluctuated in much the same manner as outside bank clearings and the value of imports.[50] Indeed, employment agreed with each of these series almost as closely as did any of the series analyzed by Professor Persons.[51]

The popular notion that increasing imports lead to unemployment is clearly disproved, insofar as general imports and cyclical unemployment are concerned. The business conditions which favor a rise of imports also foster full employment. The relationship between imports and employment is not inverse but direct.[52] Naturally, the extreme price boom of late 1906 and early 1907 affected imports and outside clearings. Probably, if the price element could be scientifically eliminated from these, the resulting indices of physical volume of imports and domestic transactions would agree with employment even more closely. Failures likewise manifest a very close agreement with the unemployment index. When failures are numerous, unemployment is severe, and *vice versa.* Recovery from depression appeared earlier in failures than in employment after the depressions of both 1904 and 1908, but the depression of 1911 influenced failures so slightly as to give the impression that employment recovered at least as early as did failures. On the whole, failures, imports, outside clearings, and employment show a marked tendency to fluctuate together.

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[49] Apparently prices account directly for only about one-third or one-fourth of the fluctuation in the value of imports or of clearings. One need not actually deflate the series to determine the net importance of the volume of imports, or of clearings, in relation, to the price element involved in their values, because the standard deviations (σ) of the several series form a rough guide. For outside bank clearings σ is 8.6 per cent, and for imports 11.9 per cent. For the price index of Bradstreet's σ is 3.6 per cent, and for that of the United States Bureau of Labor Statistics 2.8 per cent. The latter is supposed to be the better measure of the actual changes in price level; the former is more sensitive to the business cycle. The relation between the standard deviation of the available price series and that for the index of import prices, or for a price index of commodities exchanged by transactions represented in outside clearings, is not known. On the assumption that the unknown σ is in the vicinity of 3.0 per cent, price fluctuations account for about one-third of bank clearing values, and only about one-fourth of import values. In other words, fluctuations in the volume of business are in the first case twice as powerful, and in the second case three times as powerful as the price element.

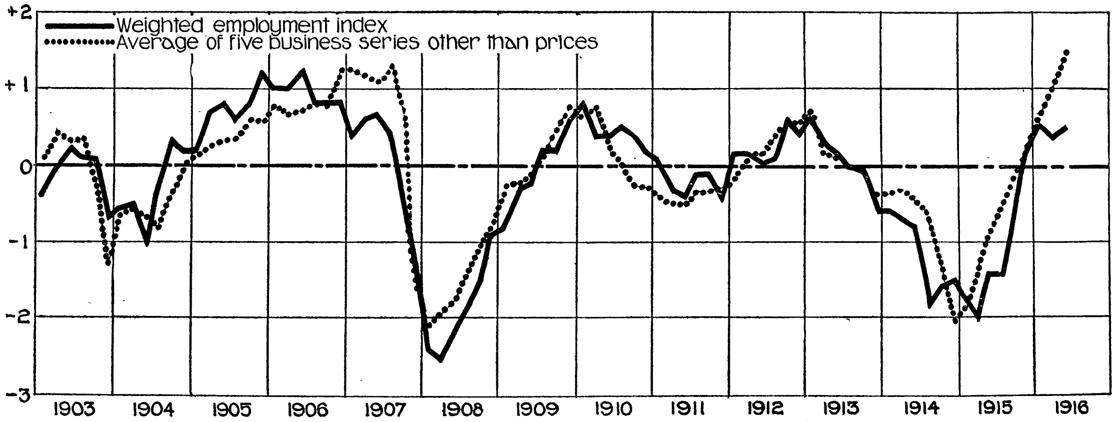
[50] Employment is a trifle more highly correlated with the former. The correlation coefficients are 78 and 77 per cent, respectively. At certain points, however, it agrees better with imports, as in the depression of 1908, especially the "turning of the corner" in the spring of that year.

[51] Of all the series analyzed, pig-iron production was the only one which agreed more closely than employment with outside clearings (82 per cent). Outside clearings was the only series which agreed as closely as employment with imports (77 per cent).

[52] It would be interesting to show whether or not increased imports tend to diminish employment in the long run and especially whether imports of particular kinds of finished goods tend to diminish employment in the line concerned, but the writer has not been able to make so intensive a study of these relationships. It is understood that the Tariff Commission is conducting such an investigation under the direction of Dr. G. B. Roorbach, whose findings will be awaited with great interest.

Chart 11. — Employment (Unemployment Inverted) and Business Activity

(Bimonthly cycles)



An average has been constructed, including the best five series relating to business activity, excluding series based solely on prices. These five are: (1) pig-iron production, (2) imports, (3) outside clearings, (4) failures and (5) unfilled orders of the United States Steel Corporation. This average does not represent dollar-volume of industrial activity; it is not an index of general business conditions comparable to "Group B" of Professor Persons. On the other hand, it is not an index of the pure quantity of production, because it contains a minor price element of perhaps 10 or 15 per cent. Nevertheless, this average is probably a closer approximation to the course of industrial activity than can readily be compiled from any other selection. It is a group which one would expect, from its economic nature, to agree statistically with employment, if employment is a good measure of industrial activity.

Chart 11 shows the employment index compared with the average of the five series. The statistical agreement is of a high order. It is much closer than that between employment and prices,[53] shown in Chart 12. These differences can in large measure be accounted for by the physical factors which tend to hold in check an increase in the volume of industrial activity even when prices run very high. Decrease of employment and productive activity can be, and during this period was, very drastic[54] for a short time, but an increase in the volume of industrial activity can be accomplished only with great and increasing difficulty during a boom.[55] This feature was especially clear in the long and pronounced boom of 1905–07. In the earlier stages of that boom, employment improved rapidly under the impulse of rising prices, and reached its upper limit not when prices were

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[53] The price index is the average of the corrected cycles for two series, Bradstreet's and that of the United States Bureau of Labor Statistics. A new price index just completed for the Committee on Economic Research by Warren M. Persons and Eunice S. Coyle shows essentially the same features of form and timing.

[54] The following discussion of the relative sensitiveness to prosperity and to depression manifested by any one series refers to the actual deviation of the corrected cycles for that series, upward or downward from its trend.

The sensitiveness of the series compared with one another is, as already suggested, best registered by the standard deviations, which for the most significant indices of business other than employment are given below, in per cent:

Unfilled orders of the U.S.S.C.	32.3
Pig-iron production	19.1
Failures	13.6
Imports	11.9
Outside clearings	8.6
Bradstreet's prices	3.7
Bureau of Labor prices	2.6

[55] The monthly indices of employment and the volume of industrial activity confirm, in this respect, the annual indices of employment and production to which attention has already been called (*supra*, p. 24). In statistical terms, the volume series have an asymmetrical distribution of corrected cycles about the time axis or line of trend; prices, on the other hand, have a nearly symmetrical distribution.

highest, but while they were still rapidly rising. The curve reached its maximum some time before 1906–07 when the price curve "cut away" from its trend and rose violently for a few months.

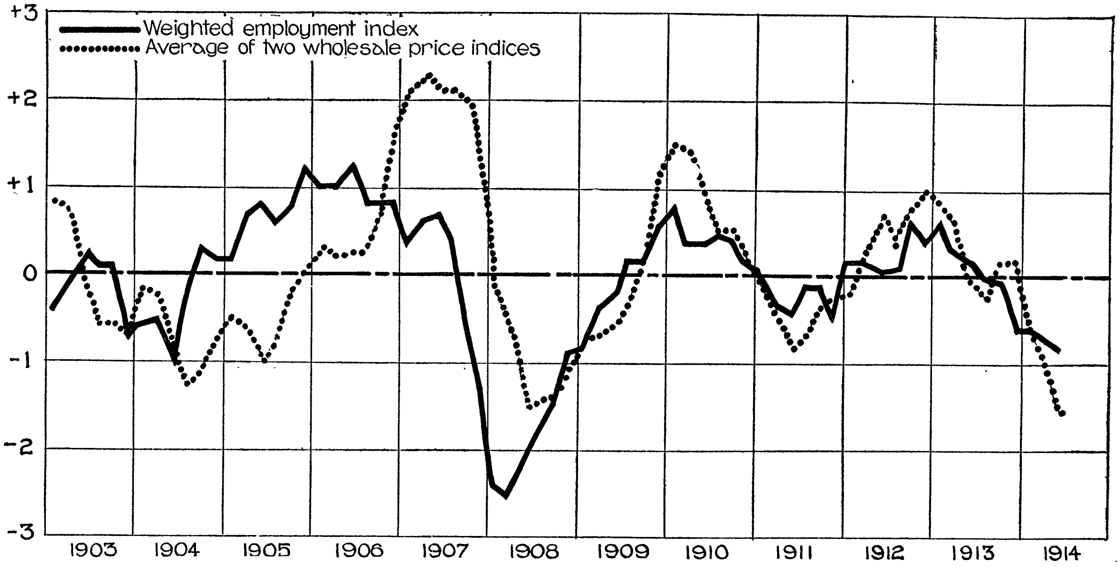
Prices show no tendency to forecast employment cycles at any time from 1903 to 1914; rather, during the earlier years they apparently lagged slightly. Employment seems to have lagged a few months after the average of the five series on several occasions, and on several others to have fluctuated concurrently with it (Chart 11). The lag is more conspicuous in the latter half of the period, when employment agreed better with price cycles in timing. (Compare Charts 11 and 12.) Clearly the panic of October–November 1907 affected employment and industrial activity at nearly the same time, leading almost overnight to wholesale discharge of workmen.

Considering the period 1903–14 as a whole, employment was found to agree with the five components of the average in Chart 11 even better than these components agreed with each other. Of the ten possible intercomparisons of the five series with each other, only one proved better than their respective comparisons with the employment index. Comparisons of employment with the other series entering the average disclosed two best fits, one tie for best fit, one second best fit, but no third best and no fourth best fits. In other words, employment seemed more "true to type" as an index of the volume of business than pig-iron production, or failures, or outside clearings, or imports; it agreed with them better than they agreed among themselves. The monthly employment index seems, then, to be an excellent register of industrial activity. Its authenticity as an industrial index has been subjected to test, including both economic and statistical judgments of the relation between employment, pig-iron production, and other indices of industrial activity. The relation between employment and prices was found perfectly explicable: close agreement in the later years, less agreement in the early years of the period under review. It is quite natural, therefore, that employment agreed less well with those volume indices which involved a price element than with those which did not, and it disagreed with none of the volume indices markedly except at the times when the price distortion is known to have been considerable, notably in 1907.

This analysis is enough to show that the index of employment and industrial activity does not measure the same thing as an index of general business conditions. "Prosperity" may be looked upon as the product of the two factors: (1) the physical volume of production and (2)

Chart 12. — Employment (Unemployment Inverted) and Prices

(*Bimonthly cycles*)

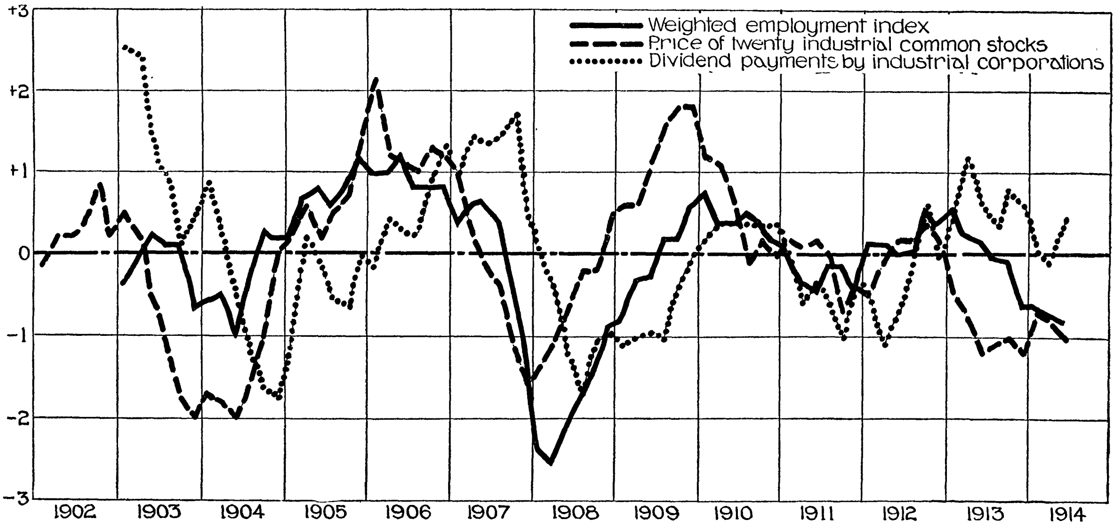


the ruling prices at which that volume is produced and exchanged. The real income of the community depends on the first alone, while the pecuniary income depends on both factors jointly. In a money régime the latter kind of income is for many practical purposes the more important, and for this reason Professor Persons has quite rightly used both price and volume elements in building up his index of general business conditions. Nevertheless, a sharp distinction between the two factors must be drawn, in studying the relation of employment to the business cycle. Prices and volumes do not necessarily fluctuate together, nor to the same degree, in response to business booms and depressions. When they diverge, employment naturally follows the volume rather than the price elements. Indeed, employment is in such close accord with all of the best indices of activity that a final index of the volume of production would certainly include the employment index itself.

The forecasting of unemployment is of paramount importance, for until we learn means of controlling business cycles, advance information as to the probable future course of unemployment is useful in remedying this one of the leading evils attendant upon them. Professor Persons' forecaster of general business conditions acted also as a good forecaster of unemployment during the period 1903–14, notwithstanding the differences in form between the employment index and the general business index. Another and possibly better forecaster of unemployment is shown in Chart 13. There are shown three cycle curves relating to industrial activity: (1) the REVIEW's price index of twenty industrial stocks, (2) the weighted employment index, and (3) dividend payments of industrial corporations.[56] Cycles of actual productive activity, as represented by employment, were reflected almost five months later by the employment index, and in about five months more by the volume of dividends distributed to stockholders. Security prices forecasted employment. Both security prices and employment forecasted earnings — the former at long range, the latter at short range.

CHART 13. — EMPLOYMENT (UNEMPLOYMENT INVERTED), SECURITY PRICES, AND DIVIDEND PAYMENTS

(*Bimonthly cycles*)



IX. A MONTHLY INDEX OF EMPLOYMENT IN GREAT BRITAIN, 1903–14

The behavior of pre-war unemployment cycles and the linkage between these and business cycles, in the United States, were substantially paralleled by conditions in Great Britain, though with some interesting divergences. The British evidence has so intimate a bearing upon the

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[56] These three indices are of course not identical in industrial composition, but they are sufficiently similar to justify the comparison.

TABLE 8. — INDUSTRIAL COMPOSITION OF UNION MEMBERSHIP REPRESENTED IN INDEX OF UNEMPLOYMENT IN THE UNITED KINGDOM

(Units: 1,000 members; one per cent)

	1903		1907		1911		1914	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Totals	360	100	623	100	759	100	993	100
1. Engineering, shipbuilding, and metals *	*196*	*54*	*248*	*40*	*280*	*37*	*387*	*38*
Engineering	139	39	158	25	178	23	241	24
Shipbuilding	57	15	60	10	57	7	73	7
Metals	...	...	30	5	45	7	73	7
2. Building	65	18	64	10	57	7	73	7
3. Furnishing and woodworking	38	11	35	6	35	5	55	6
4. Printing, bookbinding and paper	56	16	54	9	62	8	67	7
5. Coal mining	...	...	120	19	154	21	167	17
6. Textiles *	...	...	80	13	120	16	*162*	*16*
Cotton	...	...	...	...	...	...	89	9
Woolen and worsted	...	...	...	...	...	...	9	1
Other	...	...	...	...	...	...	64	6
7. Clothing	...	...	...	...	...	...	68	7
8. Others	5	1	21	3	50	6	15	2

* The figures in italics are the sums of those for the sub-groups.

American situation that it is instructive to compare the course of pre-war employment cycles in the two countries.

The monthly data on employment and unemployment in Great Britain are, in many respects, superior to the American data. The percentages of unemployment [57] are better, because in the first place disputes and disability, which were found a serious cause of disturbance in the New York data, have been eliminated from the British returns with more completeness than was possible for New York. Systems of unemployment benefit have long been in force in many important unions, and as a result their secretaries exclude from their reports those unemployed because of labor disputes, disability, malingering and sickness. Only the reports of unions having such unemployment benefits are used by the official Labour Department of the Board of Trade in its compilations. Secondly, the reporting membership each month was very large, ranging from 300,000 to 1,000,000 between 1903 and 1914. Third, the reporting unions were not distributed merely in one local administrative area but throughout the length and breadth of the country. Finally, the industrial distribution was comprehensive, as is shown in Table 8. These considerations indicate at the outset that, if New York unemployment data could yield a significant employment index for the United States, British data should yield an index of equal or greater merit.

Figures directly representing the number *employed* in various kinds of establishments do not run back far into the past, but the number of days or shifts worked per week, etc. have long been collected by the Board of Trade, for certain industries. For coal mining and cotton manufacturing this kind of employment data was analyzed,[58] but the data which have been found best as a whole, and have been utilized by the present writer in constructing a British employment index, were the trade union employment returns.

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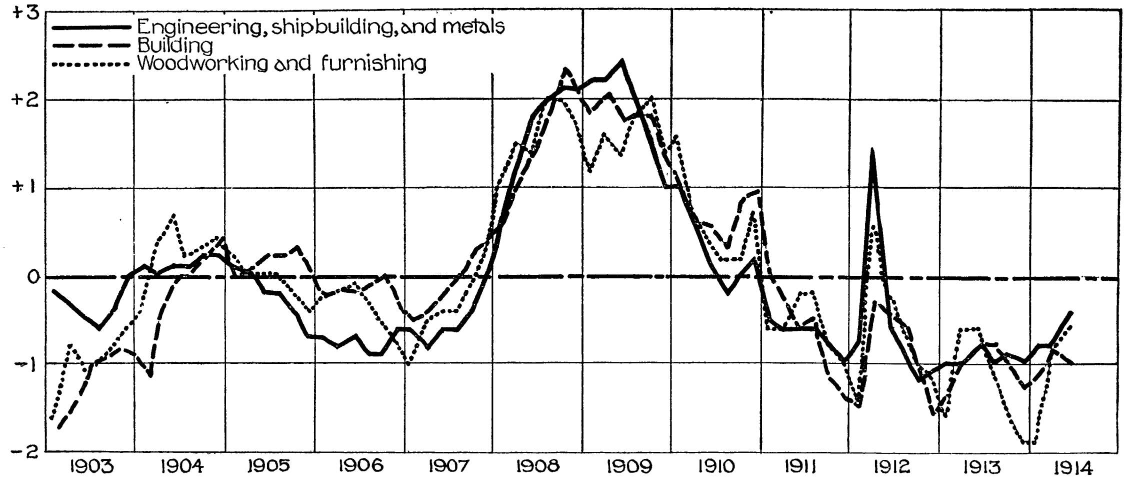
[57] Other direct evidence of fluctuations in unemployment is supplied by the numbers drawing government insurance against unemployment, and the special government out-of-work donations; but both of these series were begun at comparatively recent dates, and consequently were used only as secondary evidence.

[58] The sources for all British data on employment and unemployment were the *Abstract of Labour Statistics* and the *Labour Gazette*, published by the Labour Department of the Board of Trade.

The six leading industries for which separate series were available in the British unemployment materials throughout the period 1903–14, were: (1) engineering,[59] (2) shipbuilding, (3) metals, (4) building, (5) woodworking and furnishing, and (6) printing and bookbinding. Other industries were also introduced into the returns from time to time, and some of these, notably textile manufacturing and coal mining, became very important in the later years of the period; but only the groups for which data were available throughout the period were analyzed separately. As in the United States, the various industries differed markedly in some characteristics of employment, while in others they were strikingly similar.

CHART 14. — UNEMPLOYMENT IN LEADING TRADE GROUPS OF GREAT BRITAIN
(*Bimonthly cycles*)



The industries most acutely affected by seasonal variation were the woodworking and furnishing group, and building. The former was most active in the spring and much less so in the summer, while the latter was generally active from April through October. Both groups had a very dull winter season. Printing, which in New York seemed to have two waves of activity within the year, showed three in Great Britain. The greatest employment appeared in March, July, and especially in November; and the most pronounced unemployment occurred in late summer. In shipbuilding there was steadily changing activity, which was generally greatest in the spring, especially in March and April; in the summer unemployment increased, and from September to the end of the year it continued to be relatively severe in this industry. The engineering and metal trades were less highly seasonal, and their movements came later than in shipbuilding — activity was at a maximum in April, May and June, and at a minimum in December (see Table 9).

Yet all these industries responded to the business cycle almost simultaneously. Sometimes one, sometimes another preceded slightly, but there was no evident tendency for any of the three industrial groups shown in Chart 14 to precede or to follow the others systematically.[60]

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[59] Data for engineering and shipbuilding, but not for metals, were available separately throughout the period. The metals group comprised both ferrous and non-ferrous metals; shipbuilding included primarily the building of iron and steel ships; engineering was the working up of metals into machinery and finished products.

The average volume of unemployment indicated by all the series was small — generally smaller than in the corresponding trades in New York. Ordinarily it was about 4½ or 5 per cent in all trades combined, being greatest in building (7.3 per cent) and least in printing (4.8 per cent). The trend was downward except for printing. Since neither the volume nor the longtime trend of unemployment is the subject of the present study, the interpretation of the apparent trend and volume need not be undertaken here.

[60] Cycles for the printing industry show nearly the same relationship. The cycles for this series were omitted from Chart 14 for clearness. The chief difference was that the month-to-month fluctuations were somewhat greater, owing to the greater relative influence of slight absolute fluctuations in a series with such a low average percentage unemployed. This industry also lagged after the others slightly on several occasions.

TABLE 9. — ADJUSTED INDICES OF SEASONAL VARIATION OF UNEMPLOYMENT IN LEADING TRADES IN GREAT BRITAIN

(*Average for year = 100 per cent*)

	All trades	Engineering, shipbuilding and metals	Engineering	Ship-building	Building	Printing	Woodworking and furnishing
January	111.0	98.4	105.1	100.8	141.6	106.8	167.8
February ...	102.7	92.8	98.2	89.2	129.0	96.3	130.4
March	94.0	93.0	96.5	84.6	108.5	85.0	73.0
April	91.7	91.5	93.1	84.0	88.0	98.8	55.9
May	89.4	87.3	91.9	85.8	80.2	103.0	59.2
June	92.1	92.9	93.6	91.8	84.2	98.0	76.0
July	92.6	97.9	95.3	91.3	80.8	86.5	93.3
August	102.5	103.3	98.4	98.7	74.5	132.6	93.3
September ..	105.1	108.4	100.2	114.6	83.6	124.9	94.6
October	104.1	109.2	102.9	118.0	95.3	103.9	98.3
November .	99.9	109.6	102.3	120.4	103.0	65.5	107.5
December ..	115.0	115.5	122.5	121.0	131.0	98.6	150.7

What was the general course of unemployment during this period, irrespective of the special peculiarities of leading industries? In applying this question to American conditions, it was found that only by the use of fixed weights in combining the figures for the several industries could a reliable answer to this question be given. The three methods which were applied to the New York data were therefore applied here. Three curves were drawn: one indicating the cycles derived from the percentages unemployed in all trades, another the cycles derived by combining the cycles for the four leading industrial groups in a *weighted average*,[61] the third like the second but embodying an *unweighted average* for the four groups. The three curves were found to agree so closely that it is unnecessary to present them for inspection. In fact, it is a matter of indifference which one is taken. The one chosen to represent the general employment cycle was the first above mentioned; this is shown in Chart 15. The third shows minor irregularities and sometimes a tendency to lag, both features being due chiefly to the influence of printing. But when one considers how violent a reallocation of influence results from changing the weights of the industries to 1 apiece, from 6, 2, 1, and 1 respectively,[61] it is clear that the substantial agreement of the unweighted index with the two others would not have been disclosed if any marked differences in the timing of the component curves had taken place.[62] The British are unlike the American data, then, in one respect: the use of fixed weights was of prime importance for the New York data, but it is of no importance for the British. Both show, however, that within fairly wide limits precision in determining the fixed weights is of minor concern, owing to the nearly simultaneous movement of the component curves.

Generally speaking, labor disputes affected the unemployment indices for Great Britain somewhat less seriously than for New York, as was expected from the superior character of unemployment reports from the British unions having benefit provisions. Yet numerous labor disputes of importance took place, and these were sometimes the indirect cause of considerable *bona fide* unemployment. None, however, except the national coal dispute early in 1912 affected the course of employment profoundly. The pronounced peak in every curve in Chart 14 in February, March, and April 1912 is due solely to the lack of fuel, of transportation facilities, and of raw materials resulting from this nation-wide dispute.

The comparative unresponsiveness of the unemployment index to labor disputes, except early in 1912, is especially surprising when one considers how great was the extent of disputes during this period as a whole, and further how the effects were concentrated at certain parts of the period. In the ten years 1904–13 over 93 million man-days or 310,000 man-years were lost, directly or indirectly, through disputes in Great Britain. This is the equivalent of the work done by 31,000 men working every day throughout that period; or assuming an average working life of forty years the disputes in that decade may be said to have sacrificed the entire working lives of nearly 8000 men. Table 10 indicates how unevenly a large part of this total time loss was distributed over the period. Most of the great disputes which took place in leading British industries are listed. Comparison of Table 10 with Chart 14 shows that, in the main, the distortion caused by disputes in the unemployment curve was not great except in the spring of 1912 when one-third of the entire time loss mentioned above was incurred in coal mining in less than two months. Yet nearly all the disputes occurred in industries whose products or services were essential to other industries at later stages of manufacture.

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[61] The weights adopted were: for engineering, shipbuilding and metals combined, 6 points; building 2, woodworking, etc. 1; and printing, etc. 1. (Total 10 points.) These weights were based partly on the union membership, and partly on the total number employed in those industries throughout the country, as indicated by the Production Census of 1907.

[62] It must not be supposed, however, that the general index pictures the employment cycle in every industry. The writer has found very marked differences in the cotton industry, for example. The existence of variations in employment in the cotton, woolen, and other special industries based upon agricultural production probably does not lessen the significance of the general curve as a register of the employment cycle in industry as a whole. In the unemployment index cotton and other special industries are represented to a certain extent, and the curve probably represents a true consensus of employment cycles (see Table 8).

CHART 15. — UNEMPLOYMENT IN GREAT BRITAIN AND NEW YORK STATE COMPARED

(*Monthly cycles*)

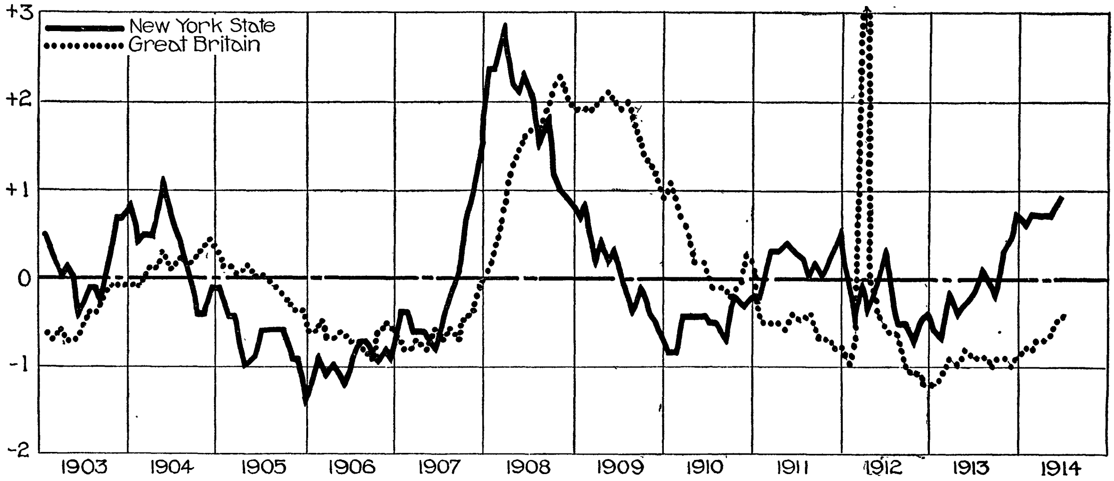

Table 10 also shows the frequency and importance of disputes in the British coal mining industry. Throughout the period under review the number of all British coal miners involved in disputes averaged 21 per cent of the total number engaged in the industry; and even excluding the extremely high figure of 1912 the average was 13 per cent, which was three times the figure for all trades combined. The worst years, aside from 1912, were 1909, 1910, and 1913, but important disputes also occurred in 1906, 1908, and 1911.[63] Indeed, labor disputes so distorted the employment curve for the coal industry as to nullify its value in studying the relation of employment in that industry to business cycles.

The general indices of unemployment in Great Britain and the United States show interesting divergences. Especially impressive are (1) the longer duration of depression in Great Britain in 1904–05 and 1908–09, (2) the comparative absence of depression in 1911 in Great Britain, and (3) the fairly consistent tendency of the British curve to lag after the American, from six months to a year. It is not yet possible to declare whether these differences in timing, etc., are inherently characteristic of the two countries, though evidence on this subject is being accumulated,[64] but the three above-mentioned fea-

[63] In 1912, 93.7 per cent of the aggregate number engaged in British coal mining were involved in disputes, chiefly the National Dispute of February–April. This figure was higher than in any other industry at any time. Even though coal mining outranked all other industries in the scope of its disputes, the largest proportions in any other pre-war years were 29 per cent in 1910 and 27 per cent in 1909. The average in all industries combined was, before the war, only 4.4 per cent. Board of Trade, *Twenty-sixth Annual Report on Strikes and Lockouts*, 1913, p. xiii.

[64] Equally if not more interesting relationships have been disclosed by a study of unemployment cycles since 1900 in five other countries: France, Germany, Belgium, Denmark and Norway. The evidences of world-wide booms and depressions given by the unemployment series are particularly significant, because in some of the countries mentioned other economic data on a monthly basis — even for highly significant series like prices — are lacking. A monthly index of cyclical unemployment in Great Britain running back to 1850 also shows curious relations to the data on unemployment in certain other countries available prior to 1900.

TABLE 10. — LEADING LABOR DISPUTES IN GREAT BRITAIN, 1905–14 *

Date	Industry	Workers involved (*thousands*)	Man-years † lost
July 1, 1905–January 31, 1906	Coal	15	760
October–November 20, 1906	Shipbuilding	15	2,000
January–September 1908	Engineering and shipbuilding	46	11,300
September 21–November 6, 1908	Cotton spinning and weaving	120	16,000
January 3–April 15, 1910	Coal	30	8,000
September 1910–August 1911	Coal	13	10,000
December 21, 1911–January 20, 1912	Cotton weaving	160	10,000
February 26–April 15, 1912	Coal	1000	103,000
May 16–August 3, 1912	Docks	100	9,000
April–July 1913	Engineering, etc.	50	4,700
August 1913–February 1914	General (Dublin)	20	6,300
January 26–August 15, 1914	Building	....	8,300

* Source: *Twenty-sixth Annual Report on Strikes and Lockouts*, Board of Trade, 1913, pp. 70–93.
† Counting one man-year as 300 man-days.

tures were unmistakable during the period covered in Chart 15.

X. THE RELATION OF EMPLOYMENT TO THE BUSINESS CYCLE IN GREAT BRITAIN, 1903–14

The relations which bind employment to the business cycle in Great Britain are in some respects analogous to those which obtain in the United States, but in other respects they are different. Cycles for two significant series indicative of business conditions in Great Britain are shown in Chart 16. They are the Sauerbeck–Statist price index of materials for use in manufacturing, and the number of furnaces in blast.[65] British like American prices bounded upward to a much sharper peak in 1906–07 than did employment, and primarily for the same reason — the influence of physical obstacles to increase of employment. The price decline during 1908–09 went to about the same extreme in the opposite direction. The decrease of employment during the trough of depression in 1908–09 was severe, but not of such long duration as the preceding boom. British prices suffered some decline during the mild American depression of 1911.

The index of employment itself seems to be the best monthly index of production in Great Britain. Actual production data were extremely scant in Great Britain before the war. Even pig-iron production was not reported except at yearly intervals, and the number of furnaces in blast was the only measure of monthly pig-iron production. The agreement between the cycles of the two industrial barometers, employment and furnaces in blast, was fairly good in form but there was a clear tendency for the blast-furnace curve to rise higher during the long boom of 1906–07. The reason is partly that at such a time the small, antiquated or inefficient furnaces put into blast naturally increases the number of blast furnaces in greater proportion than the number of employees. On the other hand, unemployment cycles (inverted) tend slightly to understate activity during booms, as already indicated (*supra*, p. 24). In their *timing*, however, the agreement was not good. There seemed to be a persistent tendency, after a depression, for the number of furnaces in blast to show recovery several months before employment improved, and a similar though less consistent precedence appeared in the change from prosperity toward depression in 1913–14. This lag of employment may be attributed in part to the interval between the less and the more advanced stages of manufacture, between pig-iron production and the production of more finished goods. This does not seem a very influential factor, especially in view of the great weight of engineering, shipbuilding, and metal industries in the employment index; the importance of iron-using industries in the British index is much greater than in the New York state index, yet in Great Britain the lag of employment after blast-furnace activity is greater, not less, than that of the American index. The explanation seems to lie elsewhere. Speculative production of pig iron in Great Britain was much facilitated by the operations of a large storage organization,[66] which advanced credits to blast-furnace operators secured by pig iron stored in the yards of the company, in much the same manner as, in the United States, credits are granted, secured by elevator receipts for grain. While speculative production of pig iron is, of course, also undertaken in the United States it seems to have been carried so much further in Great Britain that the number of active blast furnaces failed to record satisfactorily the rate of general industrial production before the war.[67] The employment series, on the other hand, has a broader industrial basis, and is much less susceptible to disputes. Furthermore, it is universally regarded as superior to the New York data, which nevertheless have been shown to serve well as an industrial index for the United States. Finally, extended search has failed to reveal any other single series with advantages equal to those of unemployment (inverted) as an index of actual industrial activity in Great Britain.[68]

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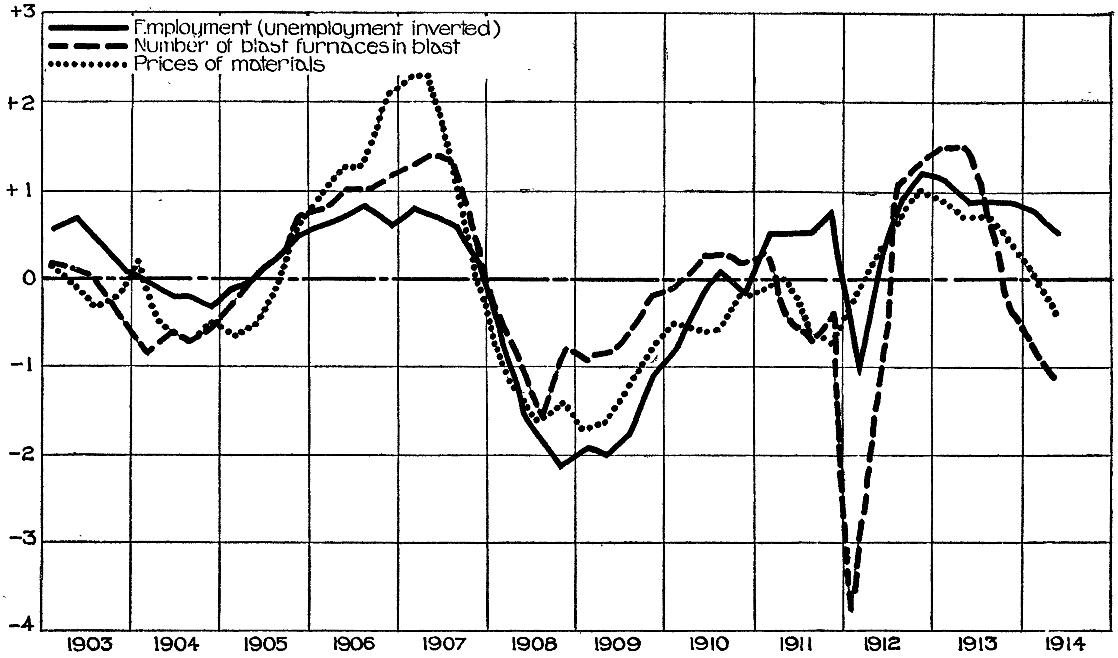
[65] These have been selected from an unpublished study of business indices in Great Britain conducted in collaboration with Professors Warren M. Persons and Norman J. Silberling.

Chart 16. — Indices of Industrial Activity in Great Britain

(Quarterly cycles)



XI. CONCLUSION

Four primary indices of employment have been presented in this paper: a monthly index for Great Britain, 1903–14, and three American indices — an annual index, 1899–1913, a monthly index, 1903–16, and a monthly index from 1919 to date. In addition, secondary or supporting indices have been developed, representing both employment and unemployment in Massachusetts. The industrial and especially the geographical basis of these indices has been restricted by the scantiness of data; yet all seem to give fairly accurate views of the employment cycles in these two countries. The New York indices, for example, seem fairly typical of industrial activity in this country. The accuracy of the employment indices is shown not only by their own internal evidence, but even more strikingly by their external relations to business indices of established worth. These unexpectedly close relationships make it highly probable that the employment indices, based primarily on trade union reports before the war and on employers' reports subsequently, measure relative fluctuations in employment with high accuracy. Employment is so "geared" to business cycles that the employment index itself ranks high as a measure of business activity. It affords a clue to cycles of industrial production, and it helps us to trace the varying impact of the business cycle upon the economic welfare of wage earners, thereby affording a clue to cycles of commercial demand.

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[66] William Connal Company's yards. It is noteworthy that the forecasting tendency is still clearer in the tabulated stocks of pig iron held in the yards at Middlesbrough and elsewhere.

[67] Another reason for the failure of the pig-iron industry to register industrial activity in general is its intimate dependence upon the coal supply which (as already shown) has long been subject to violent and extensive labor disturbances — in Great Britain more than in the United States.

[68] Foreign trade, particularly the export trade, furnished a fair guide to the volume of production though its usefulness is impaired by the presence of the price factor, the probable lag between production and exportation, and the necessary omission of the output used in domestic consumption.

GENERAL TABLES ON EMPLOYMENT

TABLE 11. — CYCLES OF UNEMPLOYMENT IN ALL TRADES AND IN SELECTED TRADES IN NEW YORK STATE, 1903–16

(*Unit: one standard deviation*)

		Weighted index; six trades combined	Building and paving	Railways	Clothing and textiles	Iron and steel	Woodworking and furnishing	Printing and bookbinding
1903	January	+ .5	+1.1	....	+ .4	− .5	+ .5	+ .2
	February	+ .2	− .1	+ .1	+1.3	−1.0	+ .6	+ .1
	March	0	− .6	− .1	+ .7	− .9	+1.9	− .1
	April	+ .1	− .2	− .7	+1.5	− .5	+ .2	+ .1
	May	0	0	− .6	+1.7	− .5	−1.1	− .2
	June	− .4	−1.3	− .4	− .3	− .3	+1.9	− .3
	July	− .1	− .7	− .5	+ .2	− .1	+1.1	+ .6
	August	− .1	− .5	− .4	+ .5	− .2	− .3	+ .5
	September	− .2	− .8	+ .1	0	− .3	+ .5	+ .2
	October	+ .1	− .9	+ .6	+ .7	+ .2	+ .6	+ .1
	November	+ .7	+ .5	+ .5	+1.9	0	+ .8	0
	December	+ .7	+ .8	+ .1	+1.5	− .1	+1 1	+ .3
1904	January	+ .8	+ .9	0	+1.5	− .1	+1.5	+ .9
	February	+ .4	+ .9	+ .3	+ .5	+ .3	−1.0	+ .1
	March	+ .5	+1.1	+ .1	+1.1	+ .2	− .6	− .5
	April	+ .5	− .4	+ .4	+2.2	+ .4	+ .5	− .3
	May	+1.1	− .5	+3.8	+1.8	+ .5	+ .8	− .1
	June	+ .9	+ .1	+1.9	+1.3	+ .5	+1.3	+ .1
	July	+ .5	− .7	+1.5	+ .2	+ .2	+2.7	+ .5
	August	+ .2	− .6	+1.0	+ .9	0	+ .5	− .2
	September	− .2	− .8	+ .5	+ .3	+ .1	−1.2	− .6
	October	− .4	− .9	+ .1	− .4	+ .1	0	− .5
	November	− .4	− .6	+ .1	− .6	0	− .5	− .5
	December	− .1	+ .8	+ .1	−1.0	− .1	0	− .7

TABLE 11. — CYCLES OF UNEMPLOYMENT IN ALL TRADES AND IN SELECTED TRADES IN NEW YORK STATE, 1903–16

(*Unit: one standard deviation*)

		Weighted index; six trades combined	Building and paving	Railways	Clothing and textiles	Iron and steel	Woodworking and furnishing	Printing and bookbinding
1905	January	− .1	+1.0	− .4	− .2	− .6	−1.1	− .7
	February	− .4	0	− .6	− .5	− .5	− .8	− .8
	March	− .4	0	− .6	− .5	− .5	− .8	− .9
	April	−1.0	− .7	−1.0	−1.0	− .8	−1.9	− .7
	May	− .9	− .9	− .9	−1.3	− .5	− .4	− .7
	June	− .6	− .4	− .8	− .8	− .5	−1.2	+ .4
	July	− .6	− .8	− .7	− .3	− .5	− .5	− .2
	August	− .6	−1.0	− .6	− .4	− .7	− .5	− .2
	September	− .6	−1.0	− .5	− .3	− .6	−1.3	+ .2
	October	− .9	−1.2	− .7	− .8	− .9	−1.1	0
	November	− .9	−1.3	− .7	−1.0	− .7	−1.1	+ .1
	December	−1.4	−2.0	−1.0	−1.6	−1.0	−1.7	0
1906	January	−1.2	−1.9	−1.0	− .9	− .9	− .9	− .3
	February	− .9	−1.3	− .7	− .4	− .9	−1.2	− .4
	March	−1.1	−2.2	− .4	− .8	− .7	−1.2	− .4
	April	−1.0	−1.4	− .9	−1.0	− .9	− .7	− .7
	May	−1.1	−1.4	−1.0	−1.0	− .8	− .9	− .7
	June	−1.2	−1.4	−1.4	−1.2	− .7	− .9	− .9
	July	− .8	− .7	−1.4	− .8	− .8	− .3	− .6
	August	− .7	− .6	−1.0	− .7	− .8	− .6	− .6
	September	− .7	− .5	− .6	− .9	−1.1	− .8	− .5
	October	− .9	− .8	−1.0	−1.0	−1.0	− .7	− .5
	November	− .8	− .8	− .6	−1.1	−1.0	− .8	− .6
	December	− .9	− .8	− .9	−1.5	− .9	− .5	− .7
1907	January	− .4	+ .7	− .8	−1.2	−1.0	−1.0	− .5
	February	− .4	+ .5	− .6	− .9	− .8	−1.2	− .5
	March	− .6	− .1	− .6	−1.2	− .9	− .5	− .5
	April	− .6	− .2	− .6	−1.2	− .9	− .2	− .9
	May	− .6	− .2	−1.0	−1.1	− .7	+ .4	− .9
	June	− .8	− .5	−1.4	−1.0	− .6	0	− .9
	July	− .6	− .2	−1.0	− .9	− .5	− .6	− .4
	August	− .3	+ .7	−1.0	− .9	− .4	− .6	− .4
	September	0	+ .9	− .8	− .6	+ .2	− .7	+ .3
	October	+ .7	+1.1	− .8	+1.2	+ .9	+1.3	+ .3
	November	+1.0	+1.5	0	+1.2	+1.9	+1.3	+ .1
	December	+1.6	+1.7	+2.3	+1.3	+2.4	+1.4	− .1
1908	January	+2.4	+2.2	+2.5	+2.1	+2.5	+2.1	+3.1
	February	+2.4	+2.7	+1.1	+2.1	+3.0	+3.0	+3.2
	March	+2.8	+2.4	+4.1	+2.1	+2.9	+2.3	+3.1
	April	+2.2	+2.1	+1.4	+2.2	+3.5	+2.2	+2.6
	May	+2.1	+2.0	+1.5	+2.0	+3.1	+2.4	+2.9
	June	+2.3	+1.9	+2.4	+2.0	+3.0	+2.4	+2.7
	July	+2.0	+2.7	+1.8	+ .9	+2.7	+1.2	+3.1
	August	+1.5	+2.4	+ .8	− .1	+1.9	+2.5	+2.3
	September	+1.8	+2.4	+1.9	+ .8	+2.1	+1.6	+1.7
	October	+1.2	+1.9	+1.0	+ .2	+1.6	+1.0	+1.5
	November	+1.0	+1.7	+ .8	− .1	+1.5	+ .9	+1.4
	December	+ .8	+1.6	+ .8	−1.0	+1.3	+ .6	+1.7

TABLE 11.— CYCLES OF UNEMPLOYMENT IN ALL TRADES AND IN SELECTED TRADES IN NEW YORK STATE, 1903–16
(*Unit: one standard deviation*)

		Weighted index; six trades combined	Building and paving	Railways	Clothing and textiles	Iron and steel	Woodworking and furnishing	Printing and bookbinding
1909	January	+ .7	+1.3	+1.2	− .9	+1.7	− .3	+1.0
	February	+ .8	+1.2	+1.4	− .7	+1.6	− .3	+1.2
	March	+ .2	+ .4	+ .5	− .7	+ .9	− .9	+ .8
	April	+ .4	+ .8	+1.3	− .3	+ .4	− .7	+ .4
	May	+ .2	+ .4	+1.0	− .5	+ .5	− .6	0
	June	+ .3	+ .4	+ .8	− .1	+ .4	− .5	+ .8
	July	+ .1	+ .3	+ .2	− .1	+ .4	− .4	− .3
	August	− .4	− .2	− .9	0	− .3	− .8	0
	September	− .1	+ .3	− .9	+ .2	− .4	− .2	+ .2
	October	− .4	− .2	− .5	− .3	− .8	− .6	− .3
	November	− .5	− .4	− .4	− .6	− .6	− .8	− .2
	December	− .6	− .7	− .6	− .7	− .7	− .8	+ .3
1910	January	− .8	− .8	− .5	−1.3	− .6	−1.1	− .3
	February	− .8	−1.0	− .8	−1.1	− .6	− .9	0
	March	− .5	− .9	− .5	+ .4	− .7	−1.4	− .3
	April	− .4	− .4	− .7	+ .4	− .9	−1.2	− .2
	May	− .4	− .2	− .7	+ .2	− .8	− .9	− .5
	June	− .4	− .1	− .9	+ .3	− .6	−1.4	− .6
	July	− .5	− .2	− .5	− .3	− .5	−1.1	−1.2
	August	− .5	− .2	− .6	− .4	− .5	−1.0	−1.3
	September	− .7	−1.0	− .2	− .6	− .4	− .8	−1.4
	October	− .2	+ .1	− .1	+ .1	− .6	− .7	−1.5
	November	− .3	− .2	− .2	+ .2	− .5	− .6	−1.4
	December	− .2	− .1	− .7	+1.0	− .6	− .1	−1.3
1911	January	− .2	− .4	− .4	+ .8	− .6	0	− .7
	February	0	+ .6	− .4	− .2	− .3	− .1	− .7
	March	+ .3	+1.1	+ .6	− .5	+ .3	0	− .9
	April	+ .3	+ .7	+1.0	− .7	+ .3	+ .1	0
	May	+ .4	+ .6	+1.0	+ .6	0	0	− .7
	June	+ .3	+ .5	+1.3	− .3	+ .5	0	−1.4
	July	+ .2	+ .2	+1.0	0	+ .8	− .3	−1.1
	August	0	+ .2	+ .5	− .8	+1.0	+ .2	−1.0
	September	+ .2	+ .2	+1.9	−1.2	+ .9	+ .5	−1.1
	October	0	+ .1	+ .7	−1.4	+1.0	+ .4	− .4
	November	+ .2	0	+ .5	+ .1	+ .6	+ .5	− .2
	December	+ .5	0	+ .6	+1.6	+ .4	+ .4	− .3
1912	January	0	− .2	− .3	+ .6	0	+ .4	− .9
	February	− .5	− .2	− .8	−1.1	− .1	+ .4	−1.0
	March	− .1	− .2	+ .7	− .8	− .2	+ .2	+ .2
	April	− .4	− .4	+ .1	−1.1	− .1	0	−1.2
	May	− .2	− .2	− .4	+ .4	− .1	0	−1.1
	June	+ .1	− .4	− .3	+1.5	0	+ .2	− .6
	July	+ .3	− .6	− .3	+2.1	− .4	0	+1.2
	August	− .5	− .4	− .5	− .7	− .6	− .5	− .2
	September	− .5	− .3	− .4	−1.4	− .5	− .4	+ .2
	October	− .7	− .6	− .3	−1.3	− .6	− .5	− .7
	November	− .5	−1.0	− .4	+ .4	− .5	− .5	− .7
	December	− .4	−1.3	− .4	+1.3	− .5	+ .2	−1.7

TABLE 12. — CYCLES OF UNEMPLOYMENT IN ALL TRADES AND IN SELECTED TRADES IN NEW YORK STATE, 1903–16

(Unit: one standard deviation)

		Weighted index; six trades combined	Building and paving	Railways	Clothing and textiles	Iron and steel	Woodworking and furnishing	Printing and bookbinding
1913	January	−.6	−1.4	−.1	−.3	−.9	+.3	+.1
	February	−.7	−1.2	−.9	−.9	−.9	+.7	+.1
	March	−.2	−1.2	+.2	0	−.8	+.4	+1.1
	April	−.4	−.7	−.8	+.2	−.8	+.2	−.3
	May	−.3	−.6	−.8	+.4	−.4	0	−.1
	June	−.2	−.1	−.9	+.4	−.5	−.3	−.3
	July	−.1	+.1	−1.0	+1.0	−.4	−.2	−.6
	August	+.1	+.1	−.8	+.8	−.4	+.3	+.7
	September	−.2	+.2	−.7	−.1	−.5	+.4	−.4
	October	+.3	+.1	0	−.1	−.4	+.9	+2.6
	November	+.4	+.1	+.2	+.9	−.4	+1.3	+.8
	December	+.7	+.2	+.4	+1.5	+.1	+.9	+1.8
1914	January	+.6	−.2	+1.1	+.9	0	+1.6	+1.5
	February	+.7	+.3	+.9	+.6	+.4	+1.6	+1.0
	March	+.7	0	+1.6	+.1	+.2	+2.1	+1.6
	April	+.7	+.7	+1.2	−.4	+.3	+1.3	+2.1
	May	+.7	+.4	+1.4	−.4	+.3	+1.2	+2.2
	June	+.9	+.8	+1.4	+.1	+.3	+1.1	+2.1
	July	+1.7	+.6	+2.4	+2.2	+.6	+1.9	+3.6
	August	+1.8	+.9	+2.8	+1.7	+.7	+1.9	+4.1
	September	+1.8	+1.4	+2.4	+.1	+.7	+2.2	+5.8
	October	+1.5	+.8	+2.6	−.1	+1.1	+1.8	+4.6
	November	+1.8	+1.1	+2.0	+1.2	+1.8	+2.1	+4.8
	December	+1.2	+.6	+2.6	+.2	+1.6	+1.8	+1.5
1915	January	+1.6	0	+3.2	+1.8	+1.2	+1.5	+3.3
	February	+1.8	+.3	+3.9	+2.1	+.9	+1.6	+2.9
	March	+2.5	+2.3	+5.7	−.3	+1.4	+1.7	+3.9
	April	+1.5	+.7	+4.0	−.2	+.8	+.8	+3.4
	May	+1.4	+.6	+2.9	+1.0	+.1	+.5	+3.5
	June	+1.4	+1.0	+3.4	+.2	−.2	+.5	+3.3
	July	+1.6	+.9	+3.4	+.5	0	+1.1	+4.9
	August	+1.3	+.9	+2.5	+.1	−.6	+.7	+5.1
	September	+.8	+.8	+2.5	−.9	−.8	+.1	+4.3
	October	+.3	0	+1.0	−1.3	−1.0	+.1	+4.2
	November	+.1	−.3	0	−.5	−1.0	−.1	+3.6
	December	−.6	−1.5	−.6	−1.1	−1.2	−.6	+2.8
1916	January	−.4	−1.2	−.8	−.7	−1.3	+1.1	+3.2
	February	−.6	−1.1	−1.1	−.8	−1.3	+.5	+2.7
	March	−.4	−1.0	+.2	−1.4	−1.2	+.7	+3.0
	April	−.3	−.3	−.6	−1.5	−1.2	+1.1	+2.4
	May	−.6	−.5	−1.4	−1.9	−1.0	+1.3	+2.2
	June	−.4	−.6	−1.2	−.9	−.9	+1.2	+2.4

TABLE 12. — EMPLOYMENT INDICES FOR LEADING INDUSTRIES AND GROUPS OF INDUSTRIES, 1919–21

(Average for 1919 = 100)

		U. S. B. L. S. (13 groups)	N.Y.I.C. (11 groups)	Average of (1) and (2)	Iron and steel	Metals, machinery and conveyances	Chemicals, oils, paints, etc.	Cotton manufactures	Woolen manufactures	Leather	Boots and shoes	Paper
1919	January	101	99	100	118	106	105	93	85	94	100	101
	February	95	98	96	111	103	102	90	50	94	100	99
	March	96	97	96	109	102	98	90	64	95	100	98
	April	96	97	96	104	99	98	91	88	95	96	95
	May	98	96	97	99	96	97	102	100	98	98	90
	June	101	96	98	99	92	97	103	114	100	97	96
	July	102	99	100	102	95	99	105	118	102	97	98
	August	101	101	101	105	99	100	105	117	103	100	100
	September	103	102	102	106	99	100	106	117	106	101	104
	October	99	101	100	70	98	100	107	118	105	103	104
	November	102	104	103	83	102	103	105	118	106	105	107
	December	105	107	106	98	106	103	109	115	106	107	108
1920	January	106	108	107	110	108	105	108	120	108	108	109
	February	106	107	106	112	107	104	106	117	105	106	108
	March	107	110	108	114	111	105	108	121	106	107	113
	April	108	109	108	113	110	104	107	121	102	106	112
	May	108	107	108	105	108	102	106	120	101	103	113
	June	108	106	107	111	108	104	107	112	97	103	113
	July	100	106	103	110	108	106	108	51	97	94	117
	August	100	104	102	109	106	106	107	47	92	94	118
	September	97	103	100	111	103	104	106	64	85	80	118
	October	94	101	98	111	102	105	103	68	80	77	118
	November	89	95	92	108	98	102	98	60	74	73	114
	December	83	88	86	98	90	97	95	48	69	74	110
1921	January	74	82	78	81	81	93	89	47	68	73	104
	February	80	82	81	81	77	91	105	68	68	79	100
	March	80	83	82	77	74	90	102	79	71	80	96
	April	80	82	81	70	70	88	101	97	63	80	86
	May	81	81	81	69	67	86	103	102	67	83	74
	June	82	79	80	65	62	85	103	104	72	87	74
	July	82	77	80	56	59	83	105	104	74	90	74
	August	81	77	79	58	59	82	106	102	75	95	75
	September	83	80	82	60	60	80	108	105	75	95	77
	October	84	82	83	64	63	82	108	105	76	94	79
	November	85	82	84	66	64	82	108	104	80	93	84
	December	86	82	84	66	66	81	108	101	84	95	84

TABLE 13. — CORRECTED MONTHLY CYCLES OF UNEMPLOYMENT IN GREAT BRITAIN, 1903–14

(*Unit: one standard deviation*)

	January	February	March	April	May	June	July	August	September	October	November	December
1903	− .6	− .7	− .6	− .7	− .7	− .6	− .4	− .4	− .3	− .1	− .1	− .1
1904	− .1	− .1	+ .1	+ .1	+ .3	+ .1	+ .2	+ .1	+ .2	+ .3	+ .4	+ .3
1905	+ .1	+ .1	0	+ .1	0	0	− .1	− .2	− .3	− .4	− .4	− .6
1906	− .6	− .5	− .7	− .7	− .6	− .7	− .7	− .8	− .9	− .6	− .5	− .6
1907	− .8	− .8	− .7	− .8	− .6	− .7	− .6	− .7	− .5	− .4	− .1	0
1908	+ .2	+ .5	+1.0	+1.3	+1.6	+1.7	+1.7	+1.9	+2.2	+2.3	+2.0	+1.9
1909	+1.9	+1.9	+2.0	+2.1	+2.0	+1.9	+2.0	+1.7	+1.4	+1.3	+1.1	+ .9
1910	+1.1	+ .7	+ .6	+ .2	+ .2	− .1	− .1	− .2	− .1	0	+ .3	+ .2
1911	− .4	− .5	− .5	− .5	− .6	− .4	− .5	− .4	− .7	− .7	− .8	− .8
1912	−1.0	− .7	+4.6	+ .1	− .4	− .6	− .6	−1.0	−1.1	−1.1	−1.2	−1.2
1913	−1.2	−1.1	− .9	−1.0	− .8	− .9	− .9	−1.0	− .9	− .9	−1.0	− .9
1914	− .8	− .8	− .7	− .7	− .5	− .4	...	...	...	...	...	...